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THE QUANTITY OF HUMAN LIFE.

BY J. LAWTON WILLIAMS.

Compared with periods of terrestrial history the duration of a human life even at the very longest is exceedingly brief. In our own time only a very few people ever live to see their hundredth birthday, and the average age is now calculated on the basis of elaborate statistics to fall between thirty-three and thirty-four years.

It seems to be a prevalent opinion among unreflecting people, that the quantity of an individual life is expressed by the number of days and years recorded on his or her tombstone. That such an opinion is erroneous will be rendered evident by a little consideration. First of all, in estimating the quantity of human life, we must possess some well defined conception of what we mean by the term life. This point settled, we can proceed with some degree of certainty in our calculation. Whoever has devoted a little thought to the subject, cannot fail to be deeply impressed with the multitude and diversity of the factors which enter into the experiences of a life-time. There are the ever changing phenomena of the external world awakening and controlling the states of consciousness. There are the equally changeful individual activities perpetually giving rise to new internal changes. In other words, there is the physiological life utilizing the forces of nature, and making them subservient to the wants of the individual economy;

and, by its side, generating and directing its activities is its ever present companion the psychological life. Here then, we have a duplicate existence, extending over a finite period of years, incessantly changing from the time of its beginning, throughout the periods of growth, maturity and decay, and ultimately resolved, so far as human observation goes, into other existences of a lower order.

Life, then is an existence. It is an existence characterized by incessant changes, and those changes are the manifestations of force. Hence, disregarding all ontological questions, the quantity of life may be measured like any other force, by the product of its intensity into the time of its duration. Let us now consider the factors which enter into and control the intensities of human life. Subjectively considered, life is obviously made up of a series of conscious experiences; objectively considered, it is made of a succession of molecular and molar motions. To avoid too great complications we will consider it only subjectively, since the objective life has much in common with the motions of dead matter.

Hobbes has well said "it is almost all one for a man to be sensible of one and the same thing, and not to be sensible at all of anything." For instance the ticking of a clock continued unintermittently through days, months, and years, forms a rhythm in the conscious life which is equivalent to silence. Not until it ceases are we aroused to a consciousness of its former existence. The same is true of all familiar and oft repeated experiences. No matter how intense and vivid may have been the first appeal of an experience, sooner or later its reiterated occurrence establishes itself in the rounded and frictionless ruts of an indifferent consciousness. It might at first be inferred from this law, that for the conscious life to attain to its maximum intensity, it should experience the rarest stimuli; and those stimuli should be as intense as possible. There is a limit however, beyond which novelties fail to be impressive, and the over stimulated and flagging consciousness relapses into apathy and indifference. But as a general rule we may be guided by Hobbes' statement, and from its converse deduce the proposition, that the intensity of

conscious life varies as the number and rarity of its experiences. But the number and rarity of its experiences depend upon a great variety of circumstances.

They depend upon the diversity of external conditions. They also depend upon the extent and acuteness of surfaces of contact, and the rapidity with which those surfaces are transported into new environments. Finally they will depend upon the stock of vitality of the individual. All these factors must be considered in estimating the quantity of the conscious life. The diversities of external surroundings are very great. Even in primitive communities, and amid the habitual isolations incident to a nomadic life, the differences in the attitudes and groupings of the objects of inanimate nature, and of the lower orders of animate nature, are ever stimulating the conscious life to new and intense experiences. Surprises, alarms, friendship, apathies, pleasures and pain are ever appealing in new and varied relations to the would-be slumbering sensibilities. But when we pass from the primitive condition of solitude to the later condition of society where the wide play of forces concerned in human interests is brought to bear in a multiplicity of combinations upon the individual life, the number of conscious experiences increases with the members of the community not in an arithmetical, but in a geometrical ratio. This holds up to a certain point when the maximum of conscious experiences during a given time is reached.

The limit is a subjective and not an objective one. It is determined by the capacity for reception of the individual. Amid the intricacies of modern civilized life that limit is speedily reached. Even the most capacious and versatile minds soon weary of the endless solicitations of the senses and the trains of ratiocination to which they give rise. The keen activity of such minds is rapidly dulled by the continuous impact of stimuli, and soon falls back upon the restful reiteration of former experiences. But even the repose of such reminiscences is disturbed by the jars and turmoils of inevitable environments, and the drowsy sensibilities are spurred on to renewed activities day after day so long as life continues. Thus it happens that the average life of the social individual

is much more intense than that of the inhabitant of solitudes. The reason is, that the sociological stimuli affect us more than stimuli of equal or even greater intensity proceeding from inanimate nature, or the lower orders of animate nature. Society also engenders wide differences in the experience of its various members on account of financial, political and other differences. The humdrum life of the common laborer is much less varied, and, therefore much less intense than the life of the gentleman of affluence and leisure who diversifies his experiences by travel, letters, society and recreative sports.

The lavish distribution of cheap literature within the last quarter of a century has immensely augmented the differences in the quantities of living among people of the same social standing. It is not uncommon to find two men engaged in the same occupation one of whom cannot read or write, while the other is conversant with the widest questions of political and social progress. Literature thus tends to obliterate the quantitative differences of life arising from certain social accidents of birth, and places all men, so far as the intellectual consciousness is concerned, on pretty much the same level as quantitative experiences. Much more might be said as to the diversities of the external conditions, but this must suffice.

We now pass on to consider the surfaces of contact. Under this designation are included all the external integuments of the body as the skin, eyes, hair, and so on. For the sake of mathematical simplicity we will assume at present that equal surfaces of contact possess equal degrees of sensibility in two individuals during equal periods of time. Then if one person present twice as much surface of contact as another, that person will, other things equal, receive twice as many peripheral stimulations as the other. (We here assume that an equal number of stimulations come from every direction against the unit of the surface.) Now the surfaces of contact vary as the square of some lineal unit. Suppose the surfaces of contact be 4 and 8 respectively; then the linear units are 2 and 2.8+. But the masses and weights of the bodies whose surfaces are 4 and 8 vary as the cube of the linear units, or as

$2^3 = 8$ and $(2\text{-}8+)^3 = 22\text{-}4+$. Now in order that the individual with double the surface of contact may encounter twice as many stimuli as the other, when both are moving through their environment, it must move the same distance as the other. In moving such a distance however, it will perform not twice but nearly three times the amount of work that the other performs since it will transport nearly three times the weight. Thus, if the expenditure of muscular energy detracts from the stock of vitality, and hence dulls the keenness of the sensibilities, even though the surfaces of contact of the two individuals possess initially the same degree of sensibility by reason of that impairment, the larger animal would experience less than twice as much consciousness as the smaller. Viewed from another standpoint, the smaller animal could execute more than twice the velocity of the larger with equal expenditure of strength, (disregarding the resistance of the medium), and hence it would encounter more than an equivalent number of experiences.

It was here assumed that equal surfaces of contact conveyed equal quantities of sensibility in the two individuals, but it is well known to physiological psychologists that there are immense differences in the relative acuteness of the different sense organs in the same individual, and in the same sense organs in different individuals. The optical, auditory and tactile powers are quite variable. Probably the experiential products of all the other senses combined do not equal those which come through the medium of vision. It will thus be readily inferred that the extent of surfaces of contact is less important in relation to the experiences of the conscious life than their quality; and the movements of the individual tending to multiply experiences are less important than the movements of the environment. For example, an observer standing on a street corner in a great city, or riding in a railway coach at forty miles an hour, will gather more experiences than he would were he to run at the top of his speed in a deserted field. Doubtless he might experience a high degree of exhilaration at first, yet experience of effort would prevail. Such experiences like all other somatic feelings have a place

in consciousness, but they certainly do not have that vivid and definite character which distinguish peripheral sensations. Moreover they must detract from the general vitality, and lower the tone of the higher orders of experience.

There can be no doubt that the stock of vitality, and the natural endowments of body and mind immensely transcend all the other differences hitherto considered. Not only do they give rise to differences in the intensity, but also in the duration of life. The vigorous, alert, and impressionable nature has a livelier consciousness of all that it experiences, responds more keenly to all its enjoyments, and resists more stubbornly the wracking and dissolution of conflict and disease. Hence such an individual lives longer and lives more. There are still other differences of a psychological character which give rise to still more important variations in the quantity of the conscious life. Owing to the absence of any standards in the higher fields of psychometric research, it is hard to discriminate between quantitative and qualitative differences. Yet viewed from a rational standpoint it cannot be doubted that different kinds of consciousness are quantitatively different, though there is no perceptible disparity in their relative intensities. That the untutored savage feels as intense gratification in the pursuit of his game, as the astronomer in the pursuit of undiscovered asteroids, cannot reasonably be doubted. But how totally different the quality of the feeling, and the psychological grounds upon which it is based! Where the thoughts and emotions are different in kind, this disparity is even greater. There are certain thoughts and emotions accessible to the few which are totally beyond and above the range of the average mind. Such thoughts as those of Laplace and Kant, and such emotions as those of Schiller, are of this order.

While it may not be easy to defend the position, yet we feel forced to believe that there are quantitative differences between such thoughts and emotions, and the stolid apathy, and gross materialistic conceptions of the mediocre mind.

Up to this point we have considered the conditions which modify the quantity of the conscious life in a general way. But the quantity of the life of every human being is subject to

innumerable vicissitudes both accidental and periodic. While there is an endless influx of disturbing forces which augment or deplete the quantity of life at all times, yet there are certain periodic causes which promote recurrence of cycles of consciousness. Such are the alterations of day and night, the recurrence of the seasons, and the widely extended observance of days and customs. How much the quantity of life is temporarily augmented by the convivialities of Christmas and other commemoration days! Then there is a diurnal rise and fall in the conscious life. The morning with its vivid and buoyant sensations; the rising of the energies and their temporary lull at midday, and their slow descent with the descending of the sun. Then the twilight comes on with its calm reflections and feelings, succeeded by the serenity of sleep. But even here the pulse of consciousness rises and falls, summoned into being by the vague apparitions and muffled ounds of dreams. At length these increase in vividness and frequency, the pulse of consciousness grows more intense until we are again ushered into the hazy realities of another morning. Then there are the periodicities arising from the changing seasons.

To one who dwells during a period of years in the same place, the events which are repeated from year to year are much in excess of those which are variable. Hence the annual rhythms of consciousness are quite well marked. The conscious life throughout the time of its existence is subject to quite well defined periods of change. There are several striking analogies between the consciousness of infancy and that of extreme old age. Both are oblivious of details, apprehending only to the salient outlines and strong qualities of things. Both repeat and re-repeat simple things, the babe its lullaby, the old man his favorite story. The consciousness of old age is reminiscent because the powers are feeble, and reminiscences are paths of least resistance. Quite otherwise is the consciousness of youth and the prime of life. It is vigilant and aggressive, and ever seeking new combinations of experience. Not only is the quantity of the conscious life extremely varied in its different periods of development, but also in its quality. In

early years and even far into the period of maturity the physiological activities prevail. Childhood and early youth are characterized by the aimless movements of spontaneity and the prodigal expenditure of physical force ; later on the psychological life rises in importance and attains its maximum when the physiological life is on the wane. This continues until the decay of old age sets in.

A grander series of changes remains yet to be considered. This is suggested by the query, how does the quantity of human life existing on the globe at the present time compare with the quantity of the antecedent times? Whoever reviews the history of the race during the nineteenth century as related to its history in previous times will observe a tremendous acceleration in the rate of living, and a vast augmentation in the intensity of human life. Notable among the causes which have secondarily conspired to this end, may be mentioned the centralization of populations. Within a century, according to the London *Journal of Statistics* the relative populations of the country and city of England have changed sides. Up to about 1840 the rural population exceeded the urban. About that year they were equal, and ever since, the cities have had a constantly increasing majority. The same is true in general of other civilized countries. Facts like these tend to show that the society of modern life is becoming more consolidated, and hence the aggregate of human experiences is becoming increasingly intense from year to year. Among the primary causes which have brought about this consolidation, are the improved facilities of travel, commerce, and communication between mind and mind. Not only have they done this, but they are the indispensible conditions of an intricate co-operative existence. But these are only a few of the many factors which enter the problem of this augmentation of life. The differentiation of pursuits and the widely diversified products of human genius, all minister to the ever broadening possibilities of human experience. To-day the child under its teens is much more sophisticated than was its semi-savage ancestors of four-score years who lived only a few generations ago. Even the lower animals in the bustling communities

lead a more varied life than primitive men, probably more varied than our contemporary the Fuegian, whose life is a monotonous ordeal of physical suffering, or the Esquimau whose days are passed in the unbroken solitudes of Arctic America. In view of these unprecedented changes, and the steady increase of population, it is but a step to the conclusion that the quantity of human life on the globe to-day is greater than ever before. In all probability the aggregate quantity of conscious life which has been experienced during the nineteenth century is far greater than the life experienced in any antecedent period of equal duration. Never was there a recorded time when the drain upon natural resources was so great as it is to-day. These resources are all turned either directly or indirectly toward the furtherance of human experience. Not only do these agencies of civilization add to the multiplicity of human experiences, but they also add to their pleasurableness. Thus undaunted by the clamors of pessimism we may firmly believe that the sum of human happiness is greater to-day than ever before.

The marked feature with which we are impressed in reviewing the evolution of human life, is its growing complexity. But by the very terms of a previous proposition, this signifies a growth in the quantity of conscious experience. All primitive life was simple and plain. Monotony was stamped upon its music, language, gesture, and the rounds of domestic, social and political life. The frequent repetitions of barbarian speech, and the sing-song tones of their music are in pitiable contrast to the sweeping climax and anti-climax of the civilized orator or opera singer.

The principle is of general application. All orders of experience are more varied in the civilized than in the savage state. Hence the quantity of life for each individual is greater, and the totality of human experiences immensely greater with the diffusion of civilization. We have now considered some of the factors which determine the quantity of human life. The final inquiry remains, how are we to live most? and how is the race to live most? Judging from the foregoing conclusions we would say in the case of the individual, that this end is

insured by multiplying the number, intensity, and variety of his experiences. Spinoza had for a motto, "to live is to think." Surely the quantity and quality of our thinking has much to do with the quantity and quality of our living, but from considerations already discussed, this utterance seems to be wanting in comprehensiveness. If this statement were true without qualifications, then he who thinks most lives most, but we have already seen that other experiences than those of thought have perhaps an equal degree of intensity, and involve an equal amount of living. Any conclusion which can be reached on this question is necessarily colored by personal prejudices, and cannot be set up as a general standard. To me, at least, he seems to live most who enjoys the greatest possible range of conscious experiences of the highest order, during the longest period of time. And the quantity of life seems to be truly greatest which embodies the fullest and highest expression of the attributes of the intellect, the emotions and the will.

Not where the experiences are confined to one of these alone, but where all three have equal sovereignty in the dominion of the mind. He seems to me to live less whose life embodies one or all of these in a less degree, or who has sullied their original purity with baser purposes and ends. Perhaps this may seem too ethical for a scientific statement but until that same ethical spirit shall more fully actuate the promoters of science, its highest beauty and usefulness cannot be completely realized. Even the best of us lead much more diminutive lives than our circumstances require. If we would but remember that it is as easy to think great thoughts as to think little thoughts, and feel great emotions instead of base and belittling ones, we might all enter into a largeness of life which far exceeds its present dimensions. But we must pass on to consider the question how can the race live most? One thing is certain, while all are permitted to think and feel and will, all cannot be brain workers. There must be doers as well. Society is so organized that no small part of its members must perform physical labor. This being the case, to realize the maximum of conscious life, there must be the greatest possible number of mental laborers, and the least pos-

sible number of physical laborers; and in each case the maximum of consciousness must be sought. Speculative as these views may appear yet they are substantiated by historical fact. To-day when the quantity of human life is greatest, the physical laborers effect most with the least effort, and the mental laborers are constantly diminishing that effort. So that were a given status of living to continue, the physical laborers would decrease, and the mental laborers would increase until finally equiblibrium should be attained.

Such equilibrium however, is indefinitely postponed by the constantly ascending standard of living. But as the standard of living ascends, all live more, and, since the physical laborers diminish and the mental laborers increase, the quantity of life is still further augmented. This would happen were the population to remain constant. But as the standard of life rises, the possibilities of existence increase, and the death rate diminishes. Consequently the population increases as the quantity of the individual life increases, and hence the total quantity of human life is augmented by both of these reciprocating factors. How great the quantity of human life may some day be is a question which the developments of the future alone can decide.

If the present rate of its growth shall continue unabated, sooner or later the time will come when it can increase no more. All the resources of the earth will be utilized and strained to the utmost to augment that life. But they cannot. Gradually the potential energies of nature which support life will be dissipated as energy of motion. And as those energies dwindle and disappear, the quantity of human life will fall away contemporaneously. The time must come when that quantity will be zero.

THE TITANOTHERIUM BEDS.

By J. B. Hatcher.

In 1857 Meek and Hayden gave the name *Titanotherium* bed to the lowest member of the fresh water, Miocene, lake deposits of the White river, Bad Lands of Dakota and Nebraska.[1] They named these beds from the genus *Titanotherium*, established by Leidy in 1852.[2] This genus embraces the largest, most abundant, and most characteristic vertebrate fossils found in these beds. In 1870 Professor Marsh discovered, in northeastern Colorado, an exposure of these beds, farther south than they had then been reported.[3] He then referred them to "The true Titanotherium beds." In 1877 Professor Marsh proposed the name Brontotherium beds for this same series of strata, from his proposed genus *Brontotherium*.[4] Since there can be no doubt that the *Titanotherium bed* M. and H., and the *Brontotherium beds* Marsh, are identical, and since the former has a priority of at least twenty years, it should be retained.[5] In this paper the plural will be used, as expressing more nearly the true nature of the deposits.

Geographical Distribution of the Titanotherium Beds.

The Titanotherium beds are known to have a surface exposure in various portions of the western interior plains region. That exposure from which they were first named and described and from which Hayden first made and published a section of them in 1863,[6] is of far greater extent than any other. The Titanotherium beds of this exposure are known to occupy a

[1]Proc. Phila. Acad. Nat. Sci., 1857, p. 120.

[2]Ancient Fauna of Nebr., Leidy, 1852, p. 72.

[3]Am. Jour. Sci., Sept., 1870, p. 292.

[4]Am. Jour. Sci., 3d series, Vol. xiv, p. 354.

[5]Titanotherium, Leidy, 1852, is antedated by Menodus Pomel, 1849 ; but Menodus is essentially preoccupied by Menodon von Meyer, 1838.

[6]Proc. Am. Phil. Soc., 1863, Vol. xii, p. 31.

considerable portion of that country embraced between the Cheyenne, Missouri, and White rivers in S. Dakota, with a western continuation, extending along the eastern and southern slopes of the Black Hills, and westward to near the town of Douglas in Wyoming. While this exposure is seen to have a considerable extent from east to west, yet from north to south it is of very limited extent. This is due to a very slight dip of these beds to the southeast, where they soon pass under the overlying Oreodon and Loup Fork beds. That range of bluffs in southwestern S. Dakota, northwestern Nebraska and central Wyoming, known as Pine Ridge, may be considered as the southern limit of this exposure of the Titanotherium beds. The beds of this region occupy a considerable portion of southwestern S. Dakota, extreme northwestern Nebraska, and a very narrow strip in central and eastern Wyoming. Besides this exposure of the beds, there are other isolated exposures at Long Pine, Nebraska; in northeastern Colorado; in Wyoming, along the Rattlesnake Range, north of the Sweetwater; and Professor Cope has described remains of Titanotheriidæ from Canada.[7]

Although the surface exposures of the Titanotherium beds are of comparatively small extent, yet from the distribution of these exposures the beds are known to extend over a considerable portion of S. Dakota, Nebraska, Colorado, Wyoming, and perhaps portions of Montana and N. Dakota.

Description of the Deposits.

The Titanotherium beds may be briefly characterized as a series of usually light colored, sometimes variegated clays, alternating with less extensive deposits of sandstones and conglomerates, situated at the base of the Miocene and containing among other fossils the remains of Titanotherium and allied forms.

The typical locality from which Meek and Hayden first named the Titanotherium beds and from which the latter first made and published a section of them, is also that locality in

[7]Contributions to Can. Pal., Vol. iii, p. 8.

the Bad Lands of S. Dakota, which has been more thoroughly explored for vertebrate fossils than any other locality in these beds. It is located in that portion of Washington county embraced between the White and Cheyenne rivers, at that point where they approach nearest to each other. This particular region has not only proved especially rich in vertebrate fossils, but the Titanotherium beds and the entire Miocene series, up to the Loup Fork, has attained a development here unsurpassed, if not unequaled, elsewhere. In no other region has erosion done more to aid the investigator than here; whether his aim be to study the country from a purely geological standpoint, to collect material for the paleontological laboratory, or to study the laws and observe the rate and effects of erosion, under the many and varied circumstances which this region presents. Since the materials composing the Titanotherium beds are very similar throughout the entire distribution of the beds, a description of the deposits at the typical locality may be considered as representing fairly well the character of the deposits at any other locality.

The section published by Hayden in 1863 agrees in all important points with those published since by other authorities. As stated by Hayden, the beds vary in thickness at different localities. At no locality has he given a thickness of more than 100 feet. The writer has found, by actual measurement, that they attain a thickness in some places at least, of 180 feet. As stated before, they are composed of clays, sandstones, and conglomerates. The clays greatly predominate, consist of very fine particles, and are quite compact. In places they are composed almost entirely of pure kaolin, but they often contain a considerable portion of sand. Near the bottom of the beds the color is often red or variegated, due to the presence in them of small quantities of red oxide of iron; but the prevailing color is a very characteristic and delicate greenish white. The clays usually contain little or no cementing substance, and are held together almost entirely by adhesion. Occasionally, however, there are quite persistent layers of clay nodules, or concretions in which the clays are firmly cemented by carbonate of lime. Owing to the extreme min-

uteness of the particles forming the clays and the absence of sufficient cementing material in them, in most places they readily yield to the action of water and are quite rapidly eroded. The clays of the Titanotherium beds were probably derived from two sources, viz., from the Cretaceous clays and shales, and from the kaolinization of granitic feldspars.

The sandstones are never entirely continuous, and never more than a few feet thick. They present every degree of compactness, from loose beds of sand to the most solid sandstones. They are composed of quartz, feldspar and mica, and are evidently of granitic origin. When solidified the cementing substance is carbonate of lime.

The conglomerates, like the sandstones, are not constant, are of very limited vertical extent, never more than a few feet thick. They are usually quite hard, being firmly held together by carbonate of lime. A section of the beds taken at any point and showing the relative position and thickness of the sandstones, clays, and conglomerates is of little value, since these vary much at different and quite adjacent localities.

The varying hardness of the different strata of the Titanotherium and overlying later Miocene beds, by offering unlike degrees of resistance to erosion, have succeeded in producing in this particular region an exhibition of characteristic Bad Lands scenery, unsurpassed elsewhere in the Miocene. The surface of the country in this region is scarred by numerous deeply eroded canyons. The intervening ridges are rugged and barren, often terminating for miles in sharp, serrated crests. The walls of these canyons present a series of terraces or projecting ledges from top to bottom, due to different degrees of hardness in the different strata. Sometimes these ledges are but a few feet wide, or just wide enough to allow a person on foot to pass along on them. At other times when the harder layers of which they are composed are of greater thickness, they may be several hundred feet wide, and their surface strewn with the fossil bones of Titanotherium, Elotherium, Hyracodon, Hyænodon, Oreodon, turtles, etc., washed

out of the overlying beds, by the slow process of denudation, presents a remarkable, not to say, sepulchral appearance.

Toward the interior of the Bad Lands, midway between the White and Cheyenne rivers, side branches of the main canyons have cut their way entirely through the dividing ridges and have produced particularly picturesque effects. Characteristic among these are the Devil's Tower, at the south end of Sheep Mountain, in the eastern portion of the Bad Lands; Chimney Rock, near their center, and the Tabled Rocks along their western border.

The location of such especially characteristic Bad Land scenery, in this particular region, is doubtless due to the near approach of the White and Cheyenne rivers to each other at this place. Since the Miocene deposits of this region are essentially horizontal, and form the summit of the divide between these two streams; this divide would be of essentially the same altitude, in reference to the beds of these streams, whether the latter were *near together* or *far removed* from each other. Therefore these streams upon approaching nearer to each other, as they do in this region, where they are only about 20 miles apart, would greatly reduce the length of their respective, intervening tributaries, without decreasing the height of the divide which separates them. This would necessarily increase the average rate of fall of the tributaries, and correspondingly the rapidity of the flow of their waters, and therefore the erosive power of the latter.

In various portions of the Titanotherium beds there are numerous vertical veins of chalcedony running through the beds in every direction. These veins vary in thickness from that of a sheet of paper to about two inches. On first thought the writer was inclined to attribute their origin to mud cracks, any particular region where they now occur having been for short periods, during seasons of low water, above the water level and subjected to the action of the atmosphere and the heat of the sun became baked and cracked; just as we now so often see at low water along the mud flats of our streams and lakes. But it is obvious that if these veins owe their origin to mud cracks they would be filled, not with chalcedony, but

with the same materials as the overlying beds; for when the waters again covered this region, the mud cracks would be immediately filled by sedimentation and with the same materials that now compose the overlying beds. It has since occurred to the writer, that these cracks were not made while the particular strata in which they now appear occupied the immediate bottom of the lake, but after the overlying beds were deposited. The extreme fineness of the particles forming the clays of the Titanotherium beds in those places where these veins occur is evidence that the clays were deposited by a slow process of sedimentation in still waters. The bottom of a lake where such materials were being laid down would consist for several feet of a very thin mud or ooze. This would gradually become firmer toward the bottom as deposition continued, but would still mechanically retain a considerable per cent. of water. Later, when the entire overlying series of strata were deposited and the region brought permanently above the water level this imprisoned water would gradually disappear, by filtration or otherwise, aided perhaps by the pressure of the superincumbent beds. This loss of moisture in the clays would diminish their volume and bring about a readjustment of the particles composing them. The decrease in volume would be taken up in two ways: First, as in the case of mud cracks, the particles would tend to collect about certain centers in the beds, and these centers of adhesion would increase laterally by the attraction of adjacent particles until cracks of varying thickness would form between the peripherys of adjacent centers of adhesion. The pressure of the overlying beds would determine the vertical direction of these cracks, and would also afford the means for the second way, by which the decrease in the volume of the clays would be taken up, viz., by a decrease in the vertical thickness of the beds. These cracks, thus formed far beneath the surface, were afterward filled by chalcedony dissolved out of the overlying beds by heated waters percolating through them. Occasionally other minerals, as ordinary calcite and its less common variety known as Iceland spar, are found in small cavities in these veins. Localities containing

these peculiar veins of chalcedony resemble both in appearance and structure a huge septaria, except that the veins in the former are much smaller in comparison with the area of the intervening spaces than in septariæ. A singular fact in connection with the position of areas exhibiting this peculiar structure is also thought to afford in itself evidence in favor of this view of the origin of the veins. These veins occur only in certain localities of limited area. Any single locality is never more than a few square miles in extent. These small and isolated areas, wherever it has been possible to determine their relation to the underlying beds, have been found to have been deposited in an eroded valley or depression of the latter. Such depressions would afford a natural basin for the waters, held mechanically by the clays, and would prevent a rapid drainage during their deposition.

Stratigraphical Position of the Titanotherium Beds.

The Underlying Beds.

The Titanotherium beds are underlaid by various older formations, from the Laramie to early Paleozoic or perhaps Archean. In most places they rest unconformably upon the eroded surface of some member of the Cretaceous, most frequently the Fort Pierre shales. At the mouth of Beaver creek, a tributary of White river, near the Nebraska and Dakota State line, the writer in 1886 observed the Titanotherium beds resting upon the eroded surface of the chalk of Cretaceous No. 3, so well developed in central and western Kansas. This is believed to be a more northwestern extension of these beds than had then been reported.

The Titanotherium Beds.

The Titanotherium beds may be divided into Lower, Middle, and Upper beds, each characterized by different forms of the Titanotheriidæ. Accepting a total thickness of 180 feet as the maximum thickness of these beds, 50 feet of this would belong to the Lower, 100 feet to the Middle, and 30 feet to the Upper beds. The different forms of Titanotheriidæ, especially

characteristic of these three divisions will be pointed out and figured later in this article.

THE OVERLYING BEDS.

The Titanotherium beds are everywhere overlaid by the Oreodon beds, except where the latter have been removed by erosion. So far as noticed there are in the Bad Lands of S. Dakota no evidence of any unconformity between the Oreodon and Titanotherium beds, unless the sudden change from one fauna to another should be regarded as evidence of an unconformity or at least as indicating a considerable break in sedimentation between the two beds.

Southwest of the Dakota Bad Lands in the extreme northwestern portion of Nebraska there seems to be some evidence of an unconformity between the Titanotherium and Oreodon beds, or at least that for a considerable period immediately following the deposition of the Titanotherium beds, this region became dry land and that the Oreodon beds were subsequently laid down upon the eroded surface of the Titanotherium beds. At the extreme head of Cottonwood creek, a small tributary of White river, from the northwest, in the northwestern part of Dawes county, there is an isolated butte composed entirely of the Titanotherium beds and containing many Titanotherium bones. The different strata composing this butte are horizontal. About one mile south of this isolated butte is a range of bluffs of the characteristic Oreodon beds, containing numerous bones of Oreodon and other associated animals.

In the first mentioned butte Titanotherium bones are found at the same altitude at which Oreodon bones occur in the bluffs to the south. Whether this occurrence of Titanotherium and Oreodon bones at the same altitude in quite adjacent beds is due to the Oreodon beds having been deposited upon the eroded surface of the Titanotherium beds, or to differences in the level of the bottom of the lake, at the beginning of the Miocene period, could not be determined. The horizontal position of the strata composing the Titanotherium butte would seem to favor the first conclusion, since if these

strata had been laid down upon a sloping bottom they would, in their lower members at least, partake of the inclination of the bottom of the lake.

About six miles northeast of the town of Chadron, in Dawes county, Nebraska, on a small branch of the west fork of Dry creek, the writer, in 1886, while collecting missing portions of the skeleton of Professor Marsh's type of *Titanotherium* (*Brontops*) *robustum,* discovered by H. C. Clifford in 1875, observed several feet above the horizon in which this remarkably complete skeleton was found, and certainly not far from the top of the Titanotherium beds, positive evidence of a break in sedimentation at this place at least. This evidence consists in the occurrence at this place of a very dark colored layer of vegetable mould about two feet thick, accumulated no doubt during a period of elevation above water level.

Owing to the fact that the Titanotherium and Oreodon beds of S. Dakota and Nebraska are approximately horizontal, it is almost impossible to determine there, just what their stratigraphic relations are. Farther west, near the head of Lance and Harney creeks, in Wyoming, the Titanotherium beds, at least, dip to the southward at a considerable angle. The writer has been unable to make any but the most superficial observations in this region, which, if carefully examined, would doubtless furnish a solution of the actual stratigraphic relations of these beds.

Professor W. P. Jenney, of the U. S. Geol. Survey, has reported to the writer an account of the discovery of a small Miocene lake in the Black Hills. As a description of this singular and interesting deposit a portion of Professor Jenney's letter is quoted. He says: "About 1879–'80 I was informed that fossil bones . . . . had been found in a prospecting shaft near Lead City. I visited the locality and obtained possession of three nearly perfect skulls . . . . These fossils I sent to Professor Marsh at New Haven, accompanied by a letter giving a sketch and full description of the occurrence, and received a reply stating that they were all *Oreodon culbertsonii* (this specific name is from memory but I think correct).

"This Miocene deposit is situated about half a mile southeasterly from Lead City, South Dakota, and nearly five miles south of the city of Deadwood, at an elevation of about 5,200 feet above the ocean. . . . . Of the extent of this tertiary deposit very little is known. It does not outcrop at the surface and appears to occupy a small, deep channel or basin eroded in the Archæan slates which outcrop on all sides within a radius of 1000 to 3000 feet. . . . . This occurrence is peculiar not only in forming an outlier to the great Miocene deposits and in occupying a basin eroded in a range of steep Archæan hills where lakes are now unknown, but also in the nature of the deposit itself, which so closely resembles, in appearance at least, the deposits of the same age on the plains. The clays of the latter were probably derived from Cretaceous shales, but the sediments filling this lake would naturally be expected to be very different, the rocks in the vicinity being Archæan slates capped by Potsdam sandstone and shales, and locally overlaid by masses of eruptive post-Cretaceous porphyry. . . . ."

That this small lake was, during Miocene times, entirely isolated from the great body of water to the eastward can hardly be questioned. The similarity just referred to by Professor Jenney as existing between the deposits of the small lake and those of the larger one is probably due to the materials composing both having been derived largely from a common source. The prevalence everywhere throughout the Miocene of large quantities of sands and conglomerates, composed of coarse grains or pebbles of quartz, feldspars, and mica, is sufficient evidence that the materials composing the beds of the Miocene were derived largely from sources other than the Cretaceous shales, which contain little sand and are always very fine grained. The coarser sands and conglomerates were doubtless derived from Jurassic, Paleozoic, and Archean rocks, and a considerable portion of the Miocene clays probably owe their origin to the decomposition of the slates of these older formations and the kaolinization of granitic feldspars.

Division of the Titanotherium Beds into Lower, Middle and Upper Beds.

During the seasons of 1886, 1887, and 1888, the writer spent fifteen months in the White River Miocene beds of S. Dakota and Nebraska, collecting material for Professor Marsh's Monograph on the *Titanotheridæ* (*Brontotheriidæ*). Among the material collected was 105 nearly complete Titanotherium skulls, and many portions of skeletons and disarticulated bones; besides the remains of many other associated animals.

Early in the season of 1886 it became apparent that certain forms of skulls were characteristic of certain horizons in the beds. This fact showed the importance of keeping, so far as possible, an exact record of the horizon from which each skull or skeleton was taken. From actual measurement the vertical range of the Titanotheriidæ was found to be about 180 feet. For convenience in keeping a record of horizons the beds were divided into three divisions of 60 feet each, and each of these three divisions was subdivided into three divisions of 20 feet each. The different skulls and skeletons, when dug out, were each given a separate letter or number, and this letter or number was placed in that subdivision of the beds from which the skull or skeleton was taken.

At present about 60 of these skulls and several more or less complete skeletons have been freed from their matrix. When studied in connection with the horizons from which they were taken, these remains show that a regular and systematic development took place in these animals from the base to the top of the beds. The most noticeable change which took place in the Titanotheriidæ was a gradual and decided increase in their size from the lowest to the uppermost beds, as is shown by the increase in the size of the skulls, fore and hind limbs, and other portions of the skeleton. Individuals found near the bottom of the beds are little, if any, larger than the living rhinoceros. From this they gradually increase in size as we go up until at the top we find a type described by Professor Marsh as Titanops, rivaling the modern elephant in size.

This increase in size from the base to the summit of the beds

was attended by a very marked development in certain portions of the skeleton, noticeable among which are the following: A variation in shape and an increase in the size and length of the horncores as compared with the size of the skulls, attended, near the summit of the beds at least, by a decided shortening of the nasals.

There were also changes taking place in the dentition of these animals, especially in the number of incisors and in the structure of the last, upper, true molar. The number of incisors, though probably never constant, even in the same species, shows a tendency to decrease in skulls found near the summit of the beds. At the base of the beds the number of incisors is from one to three on a side, while at the top there are never more than two on a side, often only one, sometimes none. In skulls from the very lowest beds the incisors have already become so rudimentary as to be no longer functional. As would be expected, the number of incisors decreased after they became of no functional value. In the matter of incisors the Titanotheriidæ were, at the time of their extermination, in a fair way to accomplish just what the somewhat related but more persistent Rhinocerotidæ have very nearly succeeded in doing, viz., the elimination of the incisor dentition. The number of incisors in the Titanotheriidæ varies with age in the same individual. These teeth were but loosely set in the comparatively thin alveolar border between the canines, and showed a decided tendency to drop out in old age, their alveoles afterward becoming entirely closed. This is well shown in several instances where on one side of a jaw there may be 1, 2, or 3 incisors, while on the other side of the same jaw there will be 0, 1, or 2 and no alveole for the missing tooth. The number of incisors can hardly be considered as of either generic or specific importance in the Titanotheridæ where they are no longer functional and vary with individuals in the same species and with age in the same individual. The same may be said of the presence or absence of the first premolar.

In the structure of the last upper true molar we find a change taking place in the development of a posterior, inner

cone. Individuals from the base of the beds show scarcely any indications of this cone, but as we proceed upward in the beds, there is a marked increase in the development of the inner basal ridge on the inner posterior angle of the last upper true molar. This development frequently succeeds near the middle of the beds in producing a perfect posterior inner cone.

Other variations are noticeable in the dentition and in the character of the nasals, but they are common to individuals from any horizon whatsoever, and are thought to be of sexual importance only. Among variations of this nature may be mentioned the following: Differences in the size of the canines as compared with the molars and premolars; presence, absence, or want of continuity of an inner basal ridge on the superior premolars; comparative strength and rugosity of the nasals. Since slender and delicate nasals, small canines and upper premolars with only a very slight or no basal ridge on the inner border, are associated in the same skulls; these skulls are considered to have belonged to females, while those skulls in the same horizons, with stronger and more rugose nasals, larger canines and a well developed inner basal ridge on the upper premolars represent their male companions.

There were also changes taking place in other portions of the skeletons of these animals, important among which may be mentioned the development of a third trochanter. Femora from the bottom of the beds were quite small and with only a rudimentary third trochanter. Toward the middle of the beds they increase in size and show a well marked third trochanter, while at the top of the beds this process has become quite well developed and is of moderate size.

The most important change that took place in the Titanotheriidæ, and the only one perhaps of generic importance, is to be found in the fore foot. Early in the season of 1886 the writer discovered near the base of the Titanotherium beds a portion of the skeleton of a very small individual with both fore feet and limbs in position. The carpus of this individual was found to possess an additional bone (*the trapezium*) hitherto unknown in the Titanotheriidæ. This fortunate discovery of a skeleton, at the base of the deposits, with a distinct trapezium

showing a perfect articulation with the trapezoid, may be found to be of considerable importance as establishing a closer relation of Titanotherium to Diplacodon from the upper Eocene than has yet been pointed out, especially if this latter form should prove to possess a trapezium, as it is now almost certain it did. The trapezium, though present in the earliest forms of the Titanotheridæ, was quite small and soon disappeared entirely, leaving no vestige of a first digit. Among many more or less complete fore feet found in the upper part of the Lower, in the Middle, and Upper beds, no trapezium has yet been found, while several have been found at the base of the beds.

It is quite probable that those forms of Titanotheriidæ with three incisors described by Professor Marsh under the generic name of *Telcodus* will be found to possess a trapezium.[8] If such should prove to be the case, the genus *Teleodus*, Marsh can then be considered as distinguished from that of *Titanotherium*, Leidy by a definite and constant character, viz., the presence of a trapezium. Individuals with three incisors collected by the writer have invariably been found at the bottom of the beds and the small size of other individuals with three incisors, discovered by other collectors, indicate that they also were taken from the same horizon. There would appear, therefore, to be little doubt that the presence of a trapezium and three incisors are associated in the same individuals. That the latter character was not constant is shown by the presence of three incisors on one side and two on the other in the same jaw, with no alveole for the missing tooth.

Variations occur also in the number of sacral vertebræ. But since these are clearly dependent upon the age of the individual they are not considered here. All fully adult specimens show four sacrals, younger ones only two or three.

In figure 3 the side view of a skull from the base of the Titanotherium beds is represented, showing the small round horncores and long nasals which are characteristic of skulls from this horizon. In figure 2 the side view of a skull from the Middle beds is represented, showing horncores and nasals of medium length. Figure 1 represents the side view of a

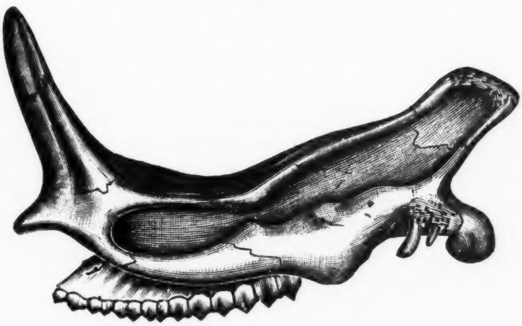
[8]Am. Jour. Sci., June, 1890, p. 524.

Oreodon Beds.		Reddish brown clays, with occasional concretionary layers, Remains of Oreodon, Hyracodon, Hyænodon, Elotherium, etc. About 500 feet thick.
TITANOTHERIUM BEDS, 180 FEET THICK.	Upper Beds, 30 ft.	Characterized by Titanotheriidæ of large size. Horns 10–18 in. long, elliptical to sub-ovate in cross-section. Nasals very short and pointed. Incisors never more than 2. Internal cingulum on upper premolars not strongly marked in either sex. Posterior inner cone on last upper molar. Third trochanter present. Trapezium absent. General form of skull shown in fig. 1.
	Middle Beds, 100 ft.	Characterized by Titanotheriidæ of medium size. Horns 4–10 in. long, circular to sub-triangular in cross-section. Nasals of moderate length, with broad or pointed extremities. Incisors never more than 2. *Strong* internal cingulum on upper premolars of males only. Posterior inner cone on last upper molar. Third trochanter present. Trapezium absent. General form of skull represented in fig. 2.
	Lower Beds, 50 ft.	Characterized by Titanotheriidæ of small size. Horns rudimentary or from 1–4 in. long, circular in cross-section. Nasals long and pointed. Incisors occasionally as many as 3. *Strong* internal cingulum on upper premolars in males only. No posterior inner cone on last upper molar. Third trochanter somewhat rudimentary. Trapezium present in earliest forms. General form of skull shown in fig. 3.
Underlying Beds.		Represented by various formations from Laramie to Archean.

Section of Titanotherium Beds showing relative thickness of Upper, Middle, and Lower Beds, with brief descriptions of forms of Titanotheriidæ common to each.

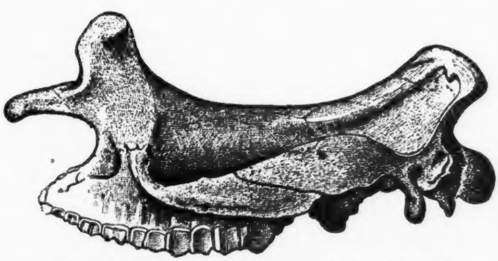
skull from the Upper beds with the characteristic long horn-cores and short nasals. The nasals are not so short in this

FIG. 1.



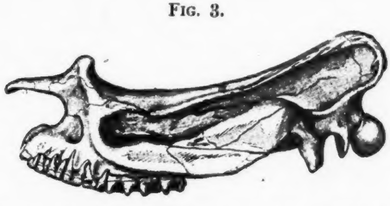
Titanotherium acre, $\frac{1}{12}$ Cope.

FIG. 2.



Titanotherium ingens Marsh; $\frac{1}{12}$ (After Marsh).

FIG. 3.



Titanotherium heloceras Cope; $\frac{1}{12}$ (After Marsh).

skull as in many others. The figures are drawn to the same scale, one-twelfth natural size, and represent well the increase

in the size of the skulls from the base to the summit of the beds. They are arranged on the opposite page in the order in which they occur in the beds commencing at the top.

Intermediate forms in the middle of the beds have a much greater vertical range than their smaller ancestors in the underlying beds or their larger survivors in the overlying beds.

Between the skulls here figured there are many intermediate forms, showing every stage of development from a very small skull found at the very bottom of the beds, which measures only 22 inches from occipital condyles to the extremity of nasals, with very rudimentary horncores only $1\frac{1}{8}$ inches high to forms similar to that represented at the top, which measure more than 36 inches from occipital condyles to extremity of nasals, with horncores over a foot long and having an expanse of two feet or more.[9]

In the section of the Titanotherium beds accompanying this paper the relative thickness of the Lower, Middle, and Upper beds are shown, with brief descriptions of forms of Titanotheridæ characteristic of each.

Much additional information bearing upon the development which took place in the Titanotheriidæ will doubtless be brought to light, when the large collections either made or purchased by the writer for use in the preparation of Professor Marsh's monograph and now numbering nearly 200 complete skulls and many more or less complete skeletons shall have been worked up. It is safe to say that there is scarcely a single foot of sediment within the entire vertical range of the Titanotheridæ that is not represented by material in this collection. Only those facts bearing upon the evolution of the Titanotheriidæ which have presented themselves to the writer in connection with his field work are set forth in this paper. It is to be hoped that the few results here recorded may suggest to other collectors the importance of keeping, as nearly as possible, accurate data of horizons; since a familiarity with the

[9]These facts were communicated by the writer to Professor Marsh in 1886, and were referred to by the latter in the Am. Jour. Sci., Feb., 1889, p. 163, and the Ninth Ann. Report U. S. Geol. S., p. 114.

different horizons as characterized by different and closely related forms is clearly indispensible in making an intelligent classification of any group of fossils, more especially when they are as highly specialized and as susceptible to the influence of constantly changing environments as were the Titanotheriidæ.

Yale Museum, Jan. 16, 1893.

AN ORGANISM PRODUCED SEXUALLY WITHOUT CHARACTERISTICS OF THE MOTHER.

By Th. Boveri.

[In offering a translation of Dr. Th. Boveri's paper, entitled Ein geschlechtlich erzeugter Organismus ohne mütterliche Eigenschaften, I have been guided by two motives. First, to make this paper, which will certainly become a classic in Biological literature, accessible to American students, since the journal in which it appeared "Sitz. d. Gesellschaft für Morphologie und Physiologie zur München" × Sitzung am 16 Juli, 1889, has a very limited circulation in this country.

In the second place, to point out the new avenues of research that such work opens. Results of this kind are of the utmost importance, inasmuch as they touch the very heart of the question of Heredity. Each advance in our knowledge gained by experimental work of this sort, carries forward rapidly our understanding of the most vital phenomena of life.

Results of this importance must be verified over and over again, until all chances of error (by no means small) are eliminated. Dr. Boveri writes that during the present Winter it is his hope to carry forward this work at Na ples.

Three small wood cuts were given in the original paper. Dr. Boveri has most generously placed at my disposal the original drawings as well as five additional figures. These are added to the present account. The original figures gave side views of the Echinus larva, the Sphærechinus larva, and the side view of the bastard larva (Echinus ♂, Sphærechinus ♀). Three of the new figures give posterior views of the same larvæ and two of the *Dwarf Larvæ.*

Weismann, referring to Boveri's work, in his essay on Amphimixis affirms that *two spermatozoa enter the enucleated* egg to form the segmentation nucleus. I wish to call attention to the foot note in Boveri's paper, where it is positively stated that only *a single spermatozoon enters the enucleated egg.*

T. H. Morgan.]

Although the law, that the substances giving the definite and hereditary characters to the cell are entirely contained in the nucleus, is at times spoken of as a very probable hypothesis, but again even as a fact, yet it may be easily shown that this can be known to us neither in the well known phenomenon of fertilization of the egg, nor through the researches already carried out, concerning the rôle of the nucleus in the protozoa.

Simple reflection shows moreover that the determination whether or not this Theory of Inheritance (Vererbungs-Theorie) is true, can be settled in one way alone, viz., to take two different sorts of cells, utilizing the nucleus of one and the protoplasm of the other, to form a new cell. If the nucleus and protoplasm are so constituted that they can exist together, then will the properties arising from this cell, made artificially, answer our question. For then either the exclusive qualities of that cell will develop which had held the nucleus, or those will arise that come from the protoplasm, or lastly, from a mixture of both; showing whether the nucleus alone or the protoplasm alone (or both of the two constituents) is able to transfer to the other the properties it possesses on account of its origin, so as to bring about a reverse result in the other.

The idea of inheritance in the narrower sense corresponds to such a choice of the two cells, that the cell produced artificially out of the nucleus of the one and the protoplasm of another forms a cell capable of development.

Moreover in the case of the egg, as in no other, an opportunity is given to solve the question; because for no other cell do we possess so accurate a method of judging of its qualities as is given in the egg by means of the adult organism that comes from the egg.

Rauber[1] has already carried on a research of this sort. He describes it as follows. " The nucleus of the first segmentation sphere of a frog's egg was drawn out an hour after fertilization, by means of a pipette stuck into it. The same process was carried out in a fertilized toad's egg. These two pipettes were exchanged, and the nucleus of the toad's egg placed in

[1]Rauber Zoologischer Auzeiger 15 March, 1886, pp. 17–.

the frog's egg, and the nucleus of the frog's egg into the toad's egg. Now if the nucleus alone carries the hereditary functions then there must develop out of the frog's egg a toad, and out of the toad's egg a frog." As was to be anticipated, the eggs did not develop further, and at first sight there seems to be no reason to expect that such an experiment should succeed. For if we were in a position to take out, without further injury, the nucleus from cells, still we could scarcely introduce by artificial means a new nucleus, without causing such fundamental alterations of the one or the other part, as to make further life impossible.

But just here Nature herself offers the solution by means of which we can accomplish our purpose, because it makes the second and more difficult part of the experiment an entirely normal process—the entrance of the spermatozoon into the egg may be utilized.

The basis for my research is founded on the discovery of the Hertwig brothers.[2] When these investigators shook for a long time the eggs of the sea-urchin in a test tube, containing a small amount of water, in order to alter them mechanically, they found that in consequence of the shaking some of the eggs fell into pieces, and while some of the pieces contained nuclei, others did not. It was further shown that these enucleated (non-nucleated) fragments, as well as the nucleated ones could be fertilized, and that an active segmentative process took place in them. What followed in these cell masses was not determined by the Hertwigs. I have myself verified this discovery during my last visit to the Zoological station of Naples, and found *that the enucleated and fertilized fragments of eggs developed as far as and formed as complete larvæ as did the perfect nucleated* egg. From the enucleated fragments which I isolated I reared in a series of dishes larvæ[3] (about half of

[2]O. and R. Hertwig. Ueber den Befruchtungs und Theilungs-Vorgang des Thierischen Eies unter dem Einfluss ausserer Agentien Jena 1887.

[3]In a more extended account of my experiments I will describe in detail the methods which must be used in order to be certain that we are dealing with pieces without nuclei, and on the other hand the best method to give the more delicate pieces favorable conditions of development. Here I may remark that in order to obtain positive results, a sufficient size of the fragment is necessary, also that they have a nearly spherical form and sufficient amount of water for their development, and that MONOSPHERIC FERTILIZATION TAKES PLACE.

them developing normally) that formed *dwarf-larvæ.* These were in some cases only one-fourth as large as the normal larvæ, but otherwise agreed perfectly with these, and even lived for the same length of time, i. e., about seven days.

This result is in itself certainly full of interest. It shows that the sperm-nucleus itself possesses all of the properties necessary to function as the first segmentation nucleus, and the result, which shows the prevailing opinion concerning the nature of fertilization to be erroneous, gives an important support to my view, published in several places, concerning the interpretation of the process. I desist from considering the point further here, in order to turn to the interpretation of the experiments dealing with the questions raised concerning inheritance.

With the possibility of fertilizing enucleated egg-pieces and of bringing these to a normal development, we have fulfilled all of the conditions in order to reach the end which Rauber failed to attain. We have an enucleated egg—for the fragment has the value of an entire egg, and we are able by means of a process of fertilization to introduce another nucleus into the egg, the egg still possessing the power to develop. And now instead of using a spermatozoon of the same species, we introduce the spermatozoon of another in order to produce the hypothetical case of "the toad's egg and the frog's nucleus."

It is even possible to bastardise the egg fragments (obtained by shaking) of one species of sea-urchin with the sperm of another species, and to rear them far enough to determine whether the developing organism shows the qualities of both species or only of the one species. For such an experiment the sea-urchin presents favorable conditions. It is possible, although the results are somewhat variable, to cross-fertilize two species standing quite far apart. And in the second place the larva of the sea-urchin shows in a very few days, principally through the development of the calcareous skeleton, a very well defined shape. This is constant for each species and so well defined for each species, that at the age of four days we can distinguish the two species of larvæ just as easily and surely as in the adult condition.

16

The two species that I have used in my research are *Echinus microtuberculatus* and *Sphærechinus granularis*. I am certain that a more favorable combination than this can be found, for although the two species are well adapted inasmuch as their larvæ differ very considerably from one another, yet there is to

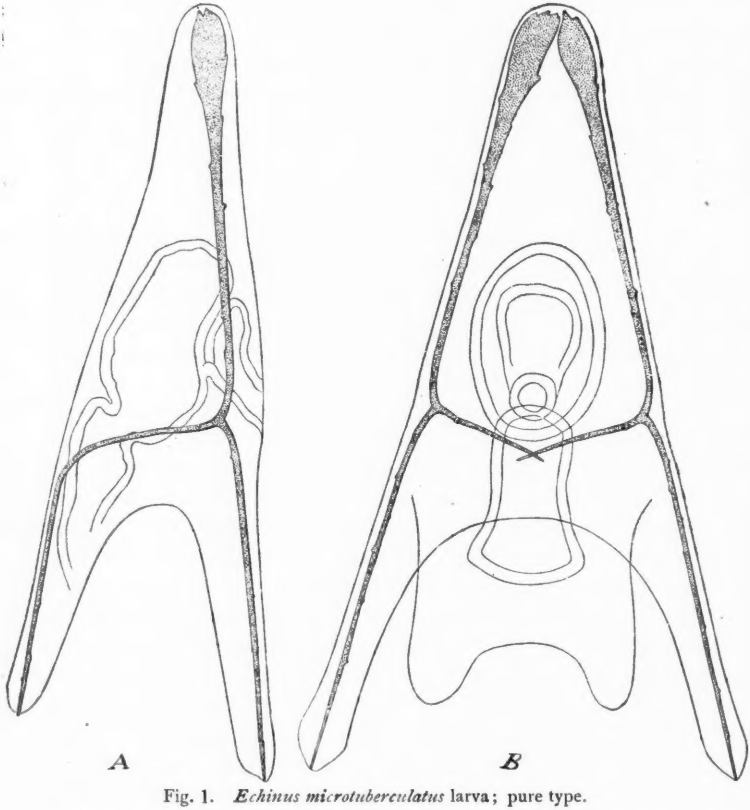
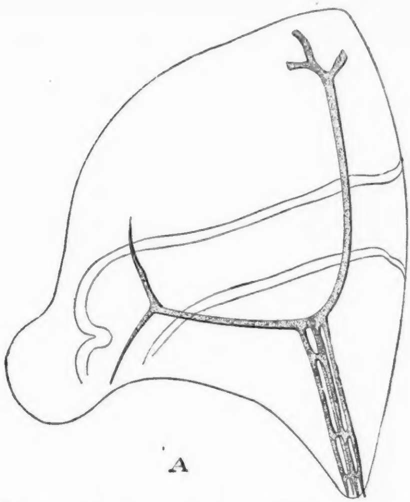


Fig. 1. *Echinus microtuberculatus* larva; pure type.

be taken into account, the fact that cross-fertilization between the two is so difficult that in my experiment out of 1000 picked eggs (Sphærechinus ♀, Echinus ♂) not a single fertilized egg resulted. Of the four species found at Naples in great abund-



A

Fig. 2. *Sphærechinus granulatus* larva; pure type.

B

Fig. 2. *Sphærechinus granulatus* larva; pure type.

ance, these two alone are useful, and lend themselves to the solution of our problem.

Since the differences throughout are dependent on the distinctive peculiarities of the larvæ used, it is necesssry first to make clear the difference in structure of the larval forms that we are considering. The two accompanying figures will render a long account needless.

Fig. 1, A and B, represents an Echinus larva, and fig. 2, A and B, that of Sphærechinus. The two figures oriented alike, show the circumference of the body and the calcareous skeleton seen in profile [and in front]. The differences in structure of the

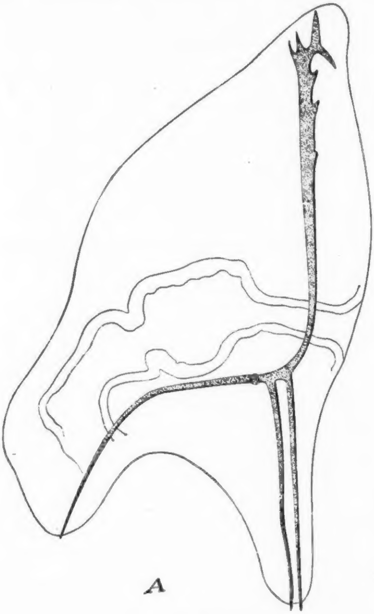
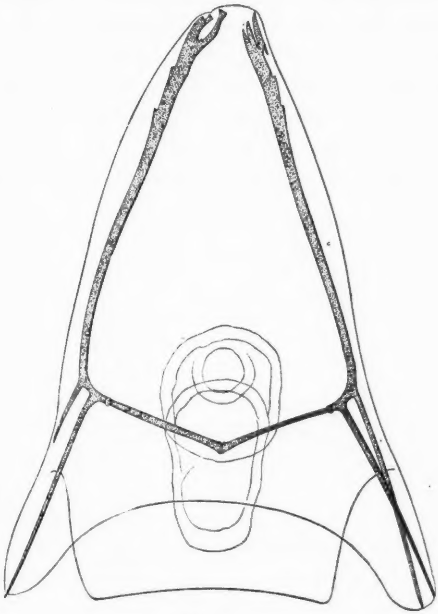


Fig. 3.
Larva of bastard of *Echinus microtuberculatus* ♂ and *Sphærechinus granularis* ♀.

body, particularly in the sheltered structures, are brought in these figures in the position best suited to the observer. The arrangement is sufficiently well shown in the figures to obviate any further description.[4] The enucleated egg-fragments of Sphærechinus were brought together with the sperm of Echinus.

[4]The generic name will suffice, from this on, in speaking of these two species.

If the nuclear substance alone is the bearer of the parental qualities, then larva of the pure Echinus type will be produced (Fig. 1). It is clear that in the experiment this conclusion can only be proved, if the bastards produced from fertilized eggs (we will call these the genuine Bastard larvæ) give a middle-form standing between the larvæ of the two parental species. For it is conceivable that the particular structures of the two



B

Fig. 3.

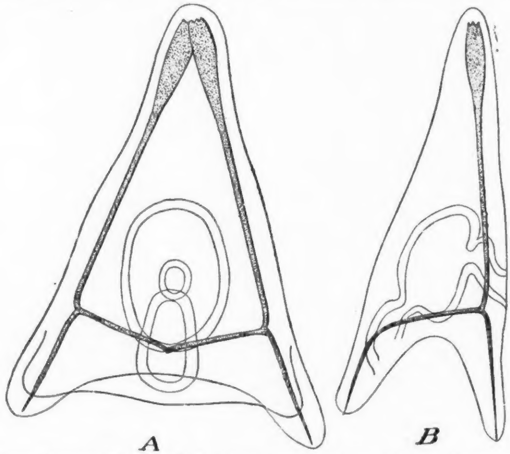
Larva of bastard of *Echinus microtuberculatus* ♂ and *Sphærechinus granularis* ♀.

species might not be able to commingle, so that the larvæ would, according to their surroundings, develop either the paternal or maternal qualities alone (the qualities of the other parent in each case remaining latent). In this case there would be no true bastard.

I have reared such larvæ in great numbers and from many different individuals, and have in all certainly seen more than

a thousand of them. The result was always the same. All genuine bastards, with not a single exception, represent both in the shape of the body as well as in the skeleton an almost exact middle form standing between the two parents. This is a new well defined form, and is always as such to be recognized and cannot be confused with either of the two parent larval forms. Fig. 3, A and B, which shows such a genuine Bastard larva, illustrates, as compared with figs. 1 and 2, this law better than many words could possibly do.

The result is otherwise if we shake into pieces the Sphærechinus egg before the entrance of the Echinus-spermatozoon. Certain of the eggs remain intact after the process, and these do give the genuine bastard form (Fig. 3). These are those formed from nucleated pieces, but another portion of the crossed



A B

Fig. 4. Dwarf bastard larva of *Echinus* ♂ and *Sphærechinus* ♀ (fragment) of pure *Echinus* type.

larvæ agree entirely with the simple larva derived from the egg and spermatozoon of *Echinus microtuberculatus* (Fig.1). These must have been produced chiefly from enucleated fragments. (Fig. 4 A and B.)

That this is the correct interpretation is more clearly demonstrated by rearing in isolation the enucleated pieces. My

results in this direction are on the whole not successful, and the explanation for this is to be found in the circumstance cited above, i. e., that the cross-fertilization between *Echinus microtuberculatus* ♂ and *Sphærechinus granularis* ♀ were scarcely ever successful out of 1000 cases. This small percentage of the whole number fertilized, where many millions of eggs or egg-fragments may be used, lends great improbability to the chance of getting successful results by isolating a few chosen examples of eggs. It is such a long and tiresome procedure to pick out and isolate the enucleated fragments from the shaken mass that in the limited time of my stay at the sea-shore I did not have the good fortune to see them develop in a single example.

I hold as sufficiently strong proof, in absence of direct knowledge, the result of those experiments in bastardization where enucleated were mingled with nucleated fragments, and with entire eggs. For after I have been able to reach the conclusion on the one hand by observing eggs and spermatozoa of the same species that enucleated pieces still develop, and on the other hand after it has been shown that the fertilization of nucleated eggs of Sphærechinus with Echinus sperm larvæ occasionally arise standing between the parent forms, there remains no other interpretation as to the origin of the dwarf-larva of pure Echinus except out of the enucleated fragments found there. But there remains a more definite result pointing to the correctness of such a conclusion. One can distinguish in a preserved and colored larva whether or not it has originated from a nucleated or enucleated egg, and this from the size of its nuclei. If the fertilized enucleated egg-fragment was the first segmentation nucleus which is formed entirely from A SPERMATOZOON NUCLEUS, the nucleus is half as large as a normal first segmentation nucleus, and this difference in size is handed down to all of the descendants of the egg cell, even to the larval stage. If now we kill larvæ of the same age derived from Sphærechinus eggs and egg-fragments fertilized by Echinus sperm, we have mixed together with the Bastard-type the true Echinus type, and the latter (true Echinus type) shows proportionately considerably smaller nuclei than the preceding one.

All doubt is thus removed, and it may be regarded as conclusive that by bastard fertilization of whole eggs or protoplasmic pieces having nuclei, larvæ are formed that stand midway between the larval forms of the parent species; but the larvæ arising from the *enucleated* fragments of eggs have entirely the characteristics of the parent (*male*) species. Herewith is demonstrated the law that the nucleus alone is the bearer of hereditary qualities. With the removal of the maternal nucleus are removed at the same time the maternal hereditary tendencies of the egg. And the maternal protoplasm, although in this case furnishing a large share of the material for the development of the new organism, is without influence on the form of the organism.

The phenomenon of growth of the enucleated protoplasmic mass is entirely governed by the introduced spermatozoon, and indeed to conclude by analogy, by the nucleus of the sperm. Whether the spermatic nucleus penetrates the egg protoplasm of its own species or of another species, the same result appears, namely, the larva is that of the male species. I might say that the nucleus possesses an assimilating power toward the protoplasm, since it produces the same sort of organism from material that appears to be different, according to our standards of truth. That the egg-protoplasm is similar in the two cases in every respect pertaining to its chemical constitution, I cannot admit, and do not even hold to be probable. Still such differences may, if they were present, be very easily explained, as due to the previous action of that nucleus, to which the enucleated protoplasm was at one time united, and any difference would thus not be incompatible with the law that all changes of form of the protoplasm are dependent on the constitution of the nucleus.

ON THE CLASSIFICATION OF THE LONGIPENNES.

BY R. W. SHUFELDT.

Few groups of birds there are that have received a greater amount of attention at the hands of comparative morphologists than the one I here consider as the Longipennes.

Considered apart from related ones, the suborder is fairly well circumscribed, and structurally, very surely a most homogeneous collection of bird-forms. It is abundantly represented in the United States avifauna, and here, as in nearly all other parts of the world, consists chiefly of the Gulls and Terns, the Skuas and Jaegers, and the Black Skimmer of the family *Rhynchopidæ.* We have the Skuas represented by but one species, *Megalestris skua;* and there are three Jaegers of the genus *Stercorarius.* There are upward of thirty Gulls referred to the genera *Gavia*, *Rissa*, *Larus* (20 species), *Rhodostethia*, and *Xema*, and about seventeen Terns, which are referred to the four genera *Gelochelidon*, *Sterna* (13 species), *Hydrochelidon*, and *Anous.*

Among the earlier classifiers of the *Laridæ*, we find P. Bruch and C. L. Bonaparte, the former being the author of two celebrated papers[1], and the latter of another which appeared between the times of their publication[2]. The confusing and

[1]Bruch, P., *Monographische Uebersicht* der *Gattung Larus Lin. J.* f. *O.*, i, 1853, pp. 96-108, pl. ii, iii.

Ibid. Revision der Gattung Larus Lin. J. f. O., iii, 1855, pp. 273-293, pll. IV, V.

[2]Bonaparte, C. L., Notes sur les Larides. Naumannia, IV, 1854, pp. 209-219. Of these two exploits Coues says in his *Ornithological Bibliography*, "It may be remarked, in fine, of this article [Bonaparte's], that it is worse than worthless, being pernicious. It is ostensibly a review of Bruch's paper of 1853 [*supra*]; this being itself a very incompetent performance, confusion is here worse confounded by Bonaparte's criticisms and "rectifications." It seems to have had, among other undesirable results, the effect of setting Bruch at the business anew, as appears by the latter's paper of 1855, [above cited]. The two authors together made as complete a muddle as can be found in ornithology; woe to the confiding student who trusts either of them—*Crede experto!* Bruch and Bonaparte are "Scylla and Charybdis of Gull literature." (p. 1001.)

misleading statments made in these three memoirs were subsequently to a large extent, eradicated by the excellent labors of Coues which appeared a few years after them,—although Coues, as he himself admits, suffered from the reliance he placed in their observations.[3]

But we are more interested in those works wherein the taxonomy of the *Longipennes* is based largely upon the structure of the various species, and this Dr. Coues gave us later in his "Birds of the Northwest," a very solid contribution to the subject.[4] Here a very thorough study was made of the Gulls, Terns, Skimmers and others. His final classification, however, appeared ten years later, or in 1884[5] and stood thus:

ORDER.	SUB-ORDER.	FAMILY.	SUB FAMILIES.
Longipennes.	Gaviæ.	Laridæ.	Lestridinæ. Larinæ. Sterninæ. Rhynchopinæ.

Other Laridists have also ably treated the group and we can here but refer the student to the works of Nitzsch, Huxley, Schlegel, Blasius, Saunders, and Sclater and Salvin, bringing us down to the year 1880. Of these Huxley's work is deserving of especial mention,[6] and he upon certain structural characters placed the Gulls and their allies in his group "*Cecomorphæ*," remarking that "This group contains the *Laridæ* (*Longipennes* Nitzsch), the *Procellariidæ*, the *Colymbidæ*, and the *Alcidæ*." (p. 458). As a knowledge of the morphology of a number of these families became extended, this classification has been very much modified and altered. For instance, Alfred Newton in the 9th edition of the *Encyclopædia Britannica* under the article GULL (v. XI, p. 274) says, "The Family Laridæ is composed of two chief groups, *Larinæ* and *Sterninæ*—the Gulls

[3]Coues, E., Revision of the Gulls (Larinæ) of North America; based upon specimens in the Museum of the Smithsonian Institution. *Proc. Acad. Nat. Sci.* Phila., XIV, 1862, pp. 291-312. Also a review of the Terns (Sterninæ) of North America. *Proc. Acad. Nat. Sci. Phila.* XIV, 1862, pp. 535-559.

[4]Coues, E., Monograph of the North American Laridæ, 1874, pp. 587-715.

[5]Coues, E., Key to North American Birds, 1884, p. 732.

[6]Huxley, Thomas H., On the Classification of Birds; and on the Taxonomic Value of the Modifications of certain of the Cranial Bones observable in that Class. P. Z. S. 1867, pp. 415-472.

and Terns, though two other sub-families are frequently counted, the Skuas (*Stercorariinæ*), and that formed by the single genus *Rhynchops*, the Skimmers; but there seems no strong reason why the former should not be referred to the *Larinæ* and the latter to the *Sterninæ*." Without being especially a classificatory work, W. K. Parker has given us some valuable researches on the development of the skull of *Gavia ridibunda* that has materially furthered our knowledge of the structure of the Gulls.

In the Check List of the American Orinthologists' Union, (1886, p. 84) we find the *Longipennes* divided into the three families *Stercorariidæ*, (2) *Laridæ* and the (3) *Rhyncopidæ*,—the second group being again sub-divided into the two sub-families, (1) the *Larinæ* to contain the Gulls, and (2) the *Sterninæ* to contain the Terns.

Finally, I have examined the classifications of Stejneger, Cope, and more particularly the one proposed by Fürbringer, and that distinguished ornithologist presents us with the following arrangement[7]:—(p. 1566.)

O. Charadriornithes.	S. O. Charadriiformes.	G. S. lat. Laro-Limicolæ.	G. s. str. Charadrii.	F. Charadriidæ.
				F. s. str. Glareolidæ.
				F. s. str. Dromadidæ
				F. Chionididæ.
				F. Laridæ.
				F. Alcidæ.
				F. Thinocoridæ.
		G. Parræ.		F. Parridæ.
		G. Otides.		F. Oedicnemidæ.
				F. Otididæ.

His order *Charadriornithes*, is also made to include the Im. S. O. Gruiformes and the Im. S. O. Ralliformes, but we are not especially concerned with them here. Among the most recent classification we find that of Doctor Sharpe; and the *Longipennes* correspond to his *Lariformes*[8], thus:—

	SUB-ORDER.	FAMILIES.	SUB FAMILIES.
Order XVII LARIFORMES.	Lari.	1. Stercorariidæ.	Larinæ
		2. Laridæ.	Sterninæ
			Rhynchopinæ

[7] Fürbringer, Max, *Untersuchungen Zur Morphologie und Systematik der Vogel*, Amsterdam, 1888.

[8] Sharpe, R. Bowdler, A review of Recent Attempts to Classify Birds. (An address delivered before the 2d Intern. Ornith. Cong., on the 18th of May, 1891.) Budapest, 1891. A most valuable contribution to scientific ornithology, and of great aid to all workers.

and he places his Lariformes between his Alciformes and Charadriiformes. (p. 72.)

My own cabinet contains numerous skeletons of Longipennine birds, and, thanks to the U. S. National Museum, I have had the opportunity of examining very many more.

Recently I have gone thoroughly over this material and written out full descriptions of the characters presented on the part of our American *Longipennes*, and chiefly from osteological data it would seem to me that the following classifications can be sustained as being probably the most natural one.

SUB-ORDER.	FAMILIES.	SUB-FAMILIES.
LONGIPENNES.	LARIDÆ.	Larinæ. Sterninæ
	STERCORARIIDÆ.	
	RHYNCHOPIDÆ.	

So far as our American *Laridæ* are concerned, and it is fair to presume that the fact obtains elsewhere in the world, we observe that certain genera among the Gulls almost insensibly approach in their structure and merge into certain genera of Terns. *Xema sabinii* is closely related to such a species as *Sterna paradisæa*, while *Gelochelidon* comes near some of the heavier built *Larinæ*.

I am of the opinion that the Skuas and Jaegers (*Stercorariidæ*, stand between the *Laridæ* and the *Rhynchopidæ*, being more nearly related to the first named than they are to the Skimmers. Indeed it would seem that the family *Rhynchopidæ* is more remotely related to either of the other two families of the Longipennes, than has heretofore generally been supposed. *Rhynchops* I have shown in a memoir that I have sent to the Journal of Anatomy (Lond.) for publication, is, in some of its osteological characters notably in the skull, the vetebral chain, and pelvis, not very unlike the fossil cretaceous bird *Ichthyornis*, and this is a very remarkable fact.

Through the *Laridæ* of the present SUB ORDER, the Longipennes are found to be not so very distantly connected with the *Alcæ*, the genus *Uria* among the Auks standing between certain Gulls and the more ancient types, such as *Plautus* and

Alca. Huxley has already shown that in another direction "the Gulls grade insensibly into the *Procellariidæ*" (P. Z. S. 1867, p. 445), and it is now generally admitted that through an easy gradation, the osteological characters of a Gull or Tern, pass into those of the Plovers and their allies among the *Limicolæ.*

Beyond the Plovers, we are led on the one hand to the Rails through the *Otididæ*, the Cranes, the *Rhinochetidæ*, and the *Psophiidæ*, while on the other, through other branches we find the Plovers linked by *Hemipodius* with the *Gallinæ.*

EDITORIALS.

EDITORS, E. D. COPE, AND J. S. KINGSLEY.

—In the States of New York, New Jersey, Pennsylvania, Alabama, and some others, the governments have been alive to the importance of retaining in the office of State Geologist a tried and competent expert. In this way they have secured the best results with the least expenditure, and have escaped the inevitable loss which results from changes in the personnel of an expert office. This loss is serious in consequence of the continuous nature of the work of a geological survey. Collections are in process of being formed, and reports of being written, and at no time can a change be made without a loss of work already done, and a loss due to the lack of continuity of work already in hand. Some States have pursued a different course, notably Indiana and Michigan, where competent men were replaced by incompetent men, and the surveys have been of little value since those changes were made. Good geologists competent for both scientific and administrative work are rare, and their excellence is in no way related to their political affiliations.

It is proposed, we regret to learn, to remove from his place the present very competent State Geologist of Illinois, Professor Lindahl. Not only has this officer had an excellent training for the place, but he has already done a vast amount of unpretentious work of the greatest value to the State of Illinois. He not only secured to the State great collections of its minerals and fossils which would have otherwise passed into private hands, but he has reduced them to order, so that they are available to the student and business men of the commonwealth. He is now engaged in making sections across the State with the view of preparing a full and final geological map. The accomplishment of this enterprise can be safely entrusted to the hands of Dr. Lindahl, and he should be supported by larger appropriations than those he has been receiving. He has done much with the limited funds at his disposal.

—M. Gréard has proposed to the French Academy that it authorize a number of changes in orthography. Among these are two which especially commend themselves to writers on scientific subjects, since they relate to words mostly derived from Greek roots. He proposes to abolish the vowel Y, and the diphthong PH, using I in place of the

former, and F in place of the latter. These reforms have been before the American public for many years, and their utility is self-evident. If the French Academy of Letters gives them the weight of its authority, we may hope to see them generally adopted. In anticipation of such approval, the Revue Scientifique initiates the movement by writing "fisiologie," "fisiognomie," "psichique," "il i a," etc. (Feb., 1893, p. 175). The American Naturalist will follow the example of the Revue Scientifique so far as it can do so at present consistently with the liberty of action of contributors and other persons, whose prejudices in favor of the old orthography it is necessary to respect.

—It is to be hoped that the present severe Winter has materially reduced the number of English sparrows in this country. Some benevolent persons have been feeding them, and no doubt have thus reduced the mortality to some extent. Such persons should remember that their benevolence is misplaced, since they are sustaining the most active enemy of the farmer known among the feathered tribes. It has been thoroughly proven that the English sparrow is not an insectivorous bird, but that it destroys great quantities of grain and fruit. It also drives away the insectivorous birds, thus doing double injury. It is not even ornamental, and the loss of the beautiful or melodious native species from our parks, which it has occasioned, is greatly to be regretted.

—The American Entomological Society occupies a room in the hall of the Academy of Natural Sciences of Philadelphia. Anxiety has been expressed by some of the members of the former lest they be compelled to vacate their quarters in the Academy Building. On the other hand some of the members of the Academy have expressed some fear lest the Entomological Society vacate voluntarily. Under the circumstances it would seem that both parties have the same object in view. This being the case, cooperation and mutual admiration must be the result, and the satisfaction of both parties be guaranteed.

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RECENT LITERATURE.

Memoirs of the National Academy of Sciences, Vol. V.—The memoirs of 1891, five in number, are published in the usual quarto form under the following titles: Energy and Vision, by S. P. Langley; Contributions to Meteorology, by Elias Loomis; Report of Studies of Atmospheric Electricity, by T. C. Mendenhall; The Embryology and Metamorphosis of the Macroura, by W. K. Brooks and F. H. Herrick; On the Application of Interference Methods to Astronomical Measurements, by A. A. Nicholson. The illustrations are numerous and good.

Brooks and Bruce on the Embryology of the Macroura.[1]—The two hundred and fifty quarto pages of this memoir are not easily summarized in a page or so of THE NATURALIST, for they include a wide range of subjects. After an introduction by Professor Brooks comes an account of the life-history of *Stenopus hispidus* by Professor Herrick; next the habits and metamorphosis of *Gonodactylus chiragra* by Professor Brooks; fourth the Metamorphosis of *Alpheus saulcyi* by Brook [*sic*] and Herrick, while the bulk of the volume is taken up by Dr. Herrick's paper: Alpheus, a study in the development of the Crustacea, which extends from page 371 to the end.

The most interesting facts connected with the reproduction of the almost cosmopolitan Stenopus are the hatching of the larva as a protozoæa with enormous mandibles and its later metamorphosis into a larva with an enormously developed fifth pereiopod, the use of which as a swimming organ has doubtless played an important part in the wide distribution of the species.

Much more important are the observations on Gonodactylus, for every fact concerning the early embryology of the Stomatopods is a positive addition to knowledge. Gonodactylus, like the others of its tribe, deposits its eggs at the bottom of its burrows, where they are aërated by the currents produced by the pleopoda of the parents. From these eggs the young hatches in an advanced condition, five abdominal segments with their appendages being outlined before the young escapes from the chorion. Professor Brooks was enabled by this material to conclusively show that the larval Stomatopod to which he

[1]The Embryology and Metamorphosis of the Macroura, by W. K. Brooks and F. H. Herrick. Memoirs Nat. Acad. Sci., Vol. v, pp. 321–576, 57 pls. Washington, 1892.

had previously given the name Gonerichthus is the young of Gonodactylus.

The account of the various species of Alpheus is most detailed and one of the most striking facts brought out is that the same species in different localities may have an almost totally different development. Thus, in the Bahamas, *Alpheus heterochælis*[2] hatches from the egg with all its appendages functional as far back as the third pair of maxillipeds, while the pereiopoda 1, 2, and 5 are bud-like rudiments, and the joint between abdominal segment 6 and the telson has not appeared and no pleopoda are outlined. At Beaufort, N. C., the species is much more advanced before leaving the egg, but the stage at which it hatches is not directly comparable with any stage in the life history of the Bahaman form. At hatching all the appendages of the adult are present, and all become functional after the first molt. In the Bahamas there is a long series of larval stages, while at Beaufort there is a great acceleration, and even this is not all; the Beaufort stages are so modified that at no time can exact parallels be drawn between them and the more southern form. In the Bahamas there are three, then four, then five, and then seven schizopodal feet with functional exopodites, while at Beaufort there are never more than three. Yet these different types of metamorphosis result in the production of adults which are almost exactly alike. It must be noted that Packard has described still another type of development for what he regards as the same species at Key West. For the details of the development of the different species of Alpheus studied we have but little room; those interested must seek the memoir itself. The segmentation in *A. saulcyi* and *A. heterochælis* is typical centrolecithal, with the formation of yolk pyramids; in *A. minus* it is irregular and has no yolk pyramids, but the statement (pp. 427 and 457) that it is amitotic deserves further investigation. All of the nuclei resulting from segmentation migrate to the surface and there by delamination they produce " wandering cells " which pass into the yolk and give rise to both mesodermal and entodermal structures. The subject of degeneration of certain nuclei is also very interesting. Dr. Herrick has carefully followed the increase of nuclei in the various parts of the embryo, and has plotted curves illustrating the distribution of primary yolk nuclei, of wandering cells,

[2]There is a great diversity in this memoir as to the spelling of various scientific terms. Thus we have usually *heterochelis* regardless of the fact that Say, who described the species, wrote *heterochælis; Alpheus minus* appears as *minus, minos* and *minor;* centrolecithal sometimes as centrolycethal; Lucifer as Leucifer.

and of all other cells, from which the reader can almost reconstruct the eggs for himself.

Only a few points more can be noted in the later history. The mouth invagination occurs on a line between the bases of the antennular buds; the history of the eye is followed, the author agreeing well in most points with Parker, but affording little support to Watase's theoretical views. The antennal gland (green gland) is regarded as mesodermal, but its opening was not found even in the larval stages; the alimentary canal proper is almost wholly made up from stomodeal and proctodeal invaginations, the true entoderm, which arises by the migration of yolk cells to the posterior end of the yolk being chiefly confined to the hepato-pancreatic diverticula and their ducts.

The greatest fault which one can find with the paper is that which is due to its composite nature, the result being an apparent lack of arrangement, so that it is difficult to follow in detail certain structures. This possibly was unavoidable where two authors were each contributing their parts and also where the composition of the text was done at different times. The volume is filled with valuable facts and cannot be ignored by the student of Crustacean ontogeny. It is by far the most valuable zoological memoir yet published by the National Academy.

Campbell's Biology.[3]—It is rarely that such a veritable hodge podge as this comes to our table. It is an example of absorption without assimilation on the part of the author. The plan of the work is fairly good but it is a misfortune for any student to have it as a guide in his studies. It is worse than the notorious works by the late Dr. Steele, for their faults were largely negative; they taught absolutely nothing good or bad, but this is "filled with lots of things that are not so." The work intends to be a companion to the laboratory work, and gives much space to protoplasm, the cell and the like, and then takes up without any apparent order the structures and classification of animals and plants. A few passages out of over a hundred which we have marked will illustrate the chief shortcomings of the work.

P. 137. The lungs "develop as an outgrowth of the alimentary canal. This outgrowth becomes completely separated off from the oesophagus, and at its lower end divides into two or more tubes, which communicate with the pharynx by a single tube, the trachea."—Pp. 145–6. The statement is made without a single qualification that the ureter of ver-

[3]Text book of Elementary Biology, by H. J. Campbell, M. D., Lond. London, Swan Sonnenschein, New York, Macmillan & Co., 1893. 12 O., pp. xii + 284.

tebrates is developed from the ectoderm and in the development of the nephridia "as a rule the ciliated funnel which was present during development, becomes completely closed." P. 85. Between the ectoderm and the entoderm of the sponges "is a gelatinous layer, the mesoglœa, amongst the cells of which crystals of lime salts occur," which we suppose to be the spicules, silicious as well as calcareous, of these organisms. P. 83. The animal kingdom is divided into Protozoa, and Invertebrate and Vertebrate Mesozoa. The Invertebrates are defined as follows: "They possess no backbone, the nerve cord or nerve cords are never dorsal, . . . and the heart is always placed in the dorsal region." The Invertebrata are subdivided into Cœlenterata and Cœlomata, but never a word that the Plathelminthes are not Cœlomata and that the vertebrates are. But enough. The work is well illustrated, mostly by cuts from Claus, Sachs, Prantl and other recent text-books.

Correlation Papers of the U. S. Geological Survey Neocene.[4]—This memoir is the fifth of a series, having been preceded by essays on the Carboniferous and Devonian by Mr. Williams, on the Cambrian by Mr. Walcott, on the Cretaceous by Mr. White, and on the Eocene by Mr. Clark. To an excellent summary of published material on the subject discussed the authors have added important original matter based on personal investigations by Mr. Dall in the field and laboratory. The following is an outline of the memoir as given in the introduction:

"This paper, after discussing general principles connected with the study and description of the Tertiary or Cenozoic rocks and fossils contained in them, takes up the Neocene deposits of the United States in particular.

"A chapter is devoted to a summary of what is known in regard to the Neocene of the eastern coast of the United States, each State in geographical order being separately considered, beginning at the north. The State of Florida, in regard to which much unpublished information was available, being entirely composed of Cenozoic rocks, and therefore as a type of such structure peculiarly interesting, is treated of in greater detail and at more length than in other cases. The part of this essay relating to the State of Florida is really a preliminary geological report on that State, of which the structure has hitherto been very little known. The important fact that until the Pliocene

[4]Bulletin of the United States Geological Survey No. 84. Correlation Papers—Neocene, By W. H. Dall and G. D. Harris. Washington, 1892.

period, Florida, so far as it was elevated above the sea, was an island separated from the mainland by a wide strait, is here first demonstrated. It is also shown that the strata are probably gently folded lengthwise of the peninsula, and that in the trough now occupied by the "lake region" of Florida in Pliocene time a large lake probably existed, to which the name of De Soto has been applied. The age of the remains of fossil vertebrate animals, which in south Florida are associated with the so-called "pebble phosphates," is here definitely determined."

After discussing by States the character and distribution of the Atlantic Neocene, a chapter is devoted to the consideration of the general geological movements and fluctuations of land, sea, currents, and water temperatures which appear to have been concerned in producing the characteristics described.

"In like manner the Neocene geology of the Pacific coast has been treated, and in addition to that of California, Oregon, and Washington, a synopsis of data relating to British Columbia has been included, together with a summary of what is known in relation to Alaska during this epoch. The latter discussion contains a large amount of material extracted from unpublished notes covering some fifteen years' study and exploration by W. H. Dall in the Alaskan region, and therefore adds materially to the sum of our knowledge in regard to that part of the United States.

"The Great Interior region of the west is then taken up, and a summary of our knowledge in regard to its Neocene geology is brought together for the first time. While this is necessarily far from perfect, the very fact that such gaps exist will stimulate the collection of information to supply the missing links.

"The essay closes with a list of names proposed for geological beds, groups, and formations in the American Cenozoic strata, and a description of the data upon which the coloration of the general map is based."

The work while an eminently important and useful one, is very unsymmetrical, as the authors themselves recognize. They are very full in describing the formations that they have seen, those of Florida, for instance, and deficient in those which they have not seen, as the lacustrine formations of the interior. The latter yet remain to receive adequate treatment from the U. S. Survey, since to do this requires the aid of a competent paleontologist of the vertebrata.

The geological map of Florida contained in this volume expresses clearly the latest discoveries in that state. The coloration will surprise

geologists who supposed that Major Powell had abandoned his extraordinary position on the question of coloration of geological maps. We seem to see in Florida a good representation of the Archean, Paleozoic and Mesozoic beds, as well as the Cenozoic. For this Mr. Dall is in no way responsible. It is a pity that expense should be incurred in printing such maps, since they will have to be republished with the customary colors.

Cary on the Evolution of Foot Structure.[5]—We have in this paper a study of the fore foot of Palæosyops, from a specimen in the museum of Princeton College, conducted with a view of ascertaining the mechanical relations of the parts when in action. The ultimate object is to determine whether the structures presented (facets, etc), can have been produced by direct mechanical impacts, strains, etc., as is alleged by the Neolamarckian school of evolutionists. The study is conducted with care, so far as it goes, but it is not always easy to understand the drift of the author's argument. He reaches but one definite conclusion, viz.; that the trapezoid is too small to express properly a result of direct mechanical causes. This fact, the author says is incompatible with the Lamarckian principle. He informs us that in reaching this result he has applied geometrical methods. "First, the volume of the bones was got at. Next the area of the bearing surfaces and their inclination to the digits were measured. Then giving to the thrust of each metacarpal a value proportional to its volume, the distribution of that thrust can by resolution and composition of forces, be traced through the foot, and the pressure on each surface and bone approximately obtained." Further than this the author does not explain how he reached the result that the trapezoid is too small. It is quite essential that this demonstration should be given if we are expected to accept his conclusion. An essential part of the problem is, however, unnoticed by Mr. Cary; and that is the condition of the trapezoid in the reptilian ancestors of the Mammalia. The phylogeny of an element must be known, since it furnishes the "physical basis" of the problem.

Mr. Cary then proceeds to criticize the explanations offered by Professor Osborn and myself, in accounting for the origin of certain structures. He finds our explanations to be self-contradictory, and that we also contradict each other. Osborn has supposed that the conules of the molars are produced by friction of the molars of opposite

[5]A study in Foot Structure; by Austin Cary. American Journal of Morphology Dec. 1892, p. 305.

series on each other. I have expressed the opinion that the shear of the sectorial teeth of Carnivora was produced by lateral friction during vertical movement of the lower tooth on the upper. I have also asserted that the forms of facets of limb articulations are due to pressure. Mr. Cary sees here the attempt to explain the origin of totally different structures through identical mechanical processes, and believes that the attempt is a failure. Were the conditions of the problems alike, as Mr. Cary thinks them to be, he would have good reason for this opinion. But the conditions in the three cases are entirely different, and our author's conclusion is due to neglect of the elementary facts of the proposition.

The development of conules at the points indicated by Professor Osborn, has been supposed by him to be due to friction between existing ridges of enamel which cross each other when in action, at the points in question. In the case of the development of the sectorial shear, the faces between which the shearing motion takes place are smooth, and without ridges or crests. Hence the entire surface receives a homogeneous friction. In the third case, that of the foot articulations, there is no friction, but there is pressure which when abruptly applied in movement becomes impact. There is really no parity between the three cases.

The author of this paper also thinks that the explanation of the elongation of bones through use of different kinds is not a permissible hypothesis. He cites my attempt to account for the elongation of the leg bones of higher mammals through impact-stimulus; and of other limb bones of other mammals through stretching. But he does not prove that similar results may not flow from mechanical stresses applied in different ways. I suppose that any mechanical stress which determines nutritive processes to a part, will increase its size, caeteris paribus; and the stretch as well as the impact has this effect.

Use is a term which is too indefinite for purposes of exact demonstration, and I have endeavored to reduce it to precision so far as regards the skeleton, by defining it as "friction, pressure and strain." Precisely how these processes affect nutrition is not yet clear. We refer the production of various animal fluids to "secretion", knowing that the products of secretion are most various, as bile, gastric juice, saliva, etc. The exact cause of the diversity remains unknown. So with the effect of stimuli on bone nutrition, we see the cause and the effect, but the ultimate process, as in all nutrition, has as yet eluded our view.

In concluding, Mr. Cary admits one of the two contentions of the Neolamarckians in his two closing propositions. He says "Plasticity

of bone, using the word *plasticity* not in a physical sense merely, but to include absorption under pressure, will probably account for much structure in the foot and elsewhere, especially the connection with the joints, and in the fields of variation and correlation." In the second proposition he says that facts have been adduced by him which are inconsistent with the theory that the size of bones has been increased by the stimulus they receive, and with the theory that regions of growth are determined by regions of pressure and strain. "The testimony of the literature as to the latter point he says is conflicting." I have shown that the supposed conflict is due to a misunderstanding on the part of the author of this paper. The proposition that pressure does not affect growth is in contradiction to the admission made by the author in his first proposition, where he admits that pressure determines structure; for in such change of structure there is always growth. Finally Mr. Cary remarks "That race changes follow those produced in the individual life, or that they are directly caused by their mechanical surroundings, I do not think it has been satisfactorily shown." The fact that the characters of bone structure admitted by Mr. Cary to have had a mechanical origin appear in the young before birth, is evidence that race characters are produced, and that they are produced by mechanical surroundings.

Such criticisms as are contemplated by the author of the paper reviewed above, are important and are what the subject needs. It is along the line followed by him that the ultimate demonstration of the problems involved will be made. We trust that we shall hear from him again in this field, and that in his labors he will be well supplied with the phylogenetic details as a foundation.

E. D. COPE.

Earle on the Species of Coryphodontidæ.[6]—In preparing this paper Mr. Earle had the advantage of the use of the material in the collections of the New York American Museum of Natural History, and the private collection of Professor E. D. Cope. He presents us with a brief résumé of the results of his comparisons, and adds considerably to our knowledge of the characters of the skeleton and dentition of some of the species. He gives a list of the described species, which number twenty-one, and which were referred by Cope to five genera. He concludes that these should be reduced to ten

[6]Revision of the species of Coryphodon, Art. xii, Bull. Am. Mus. Nat. History New York, iv, pp. 149–66; Oct. 18, 1892.

species and three genera, viz., Coryphodon Owen, Ectacodon Cope, and Manteodon Cope.

Mr. Earle's conclusion that the supposed genus Bathmodon is not distinct from Coryphodon may be well founded, as the material at his disposal is better than mine. The difference in the forms of the astragali of the two types is, however, greater than is usual in a single genus, and is seen in material from all localities. The character on which the genus Metalophodon rests is a strong one, provided it be constant. Mr. Earle says it is not constant, and if his material demonstrates this to be the case the genus must be abandoned. I do not, however, think that he demonstrates his case in the paper under review.

Let us now see the evidence on which he reduces my reputed twenty-one species to ten. In the first place he fails to state that I had already reduced two of the names to the rank of synonyms, leaving nineteen species to my credit; that is to say, nine specific names remain which are alleged to be superfluous. One of these is, however, admitted to be good by Mr. Earle. He refers *C. simus* and *C. latidens* to *C. elephantopus*, but says also that the former two are "quite radically distinct." Both cannot, therefore, be synonyms of the same species unless "things *not* equal to one another are equal to the same thing." I described the lower molars which probably belong to the *C. elephantopus*, and they are totally different from those of the *C. latidens*. The superior last molar of *C. simus* is different from that of the *C. elephantopus*. The three species are in my opinion well distinguished. This reduces the supposed superfluous names to seven.

Mr. Earle does not admit the *Metalophodon armatus* for reasons which are insufficient. As I took the greater part of the dental series from one decayed skull, and an almost equally large series from a second skull, and as the two series confirm each other, I believe the species to be one of the most distinct of the family. This reduces the supposed excess to six. As to the *C. cuspidatus*, the last inferior molar teeth of three individuals are now known, and they confirm each other not only by their characters but by their inferior size. Mr. Earle admits this species with doubt. The *C. marginatus* is rejected by him as probably founded on a milk tooth of *C. anax*. But it is not a milk tooth,[6] but an unworn permanent tooth of a species of hardly half the bulk of the *C. anax*. Coryphodon did not possess milk teeth of this form. The surplus is now five names. There are three forms of approximately similar and smaller size, viz., *C. latipes*, *C. molestus* and

[6]I have represented the milk dentition of Coryphodon on Plate liv, fig. 3, of the U. S. G. G. Survey, Report Capt. Wheeler, iv, 1875.

C. simus, which Mr. Earle refers to the *C. elephantopus*, but of which the second and third do not exhibit the form of the last superior molar which he regards with me as characteristic of the latter species. It is not unlikely that *C. simus* and *C. molestus* are one and the same, but the evidence is not yet in favor of their being identical with the *C. marginatus*. It is probable that these specimens represent at least one distinct species of rather small size.

In conclusion I think that Mr. Earle has been hasty in his wholesale reductions, and that instead of ten species in the American Wasatch beds there are at least fifteen recognizably described. It is evident that more material and more research are necessary before a larger number than this can be demonstrated and before those which are admitted can be fully defined. A considerable part of Mr. Earle's conclusions may be due to the fact that, as he says, he has "labored under the disadvantage of not being able to study any of the types of Coryphodon from New Mexico which have been described by Professor Cope."

The Coryphodontidæ were the predominant type of the Wasatch (Suessonian) Eocene, and they were probably numerous in species and varied in character. If the bones and teeth of the existing African antelopes were mixed up and discovered piecemeal, they would puzzle naturalists, who would at first be incredulous as to their representing over forty species.—E. D. Cope.

General Notes.

GEOGRAPHY AND TRAVELS.[1]

Africa.—GARENGANZE.—Garenganze, the land ruled by Mshidi, between Lakes Mwero and Tanganyika, has recently been visited both from the east and from the west. Mr. Alfred Sharpe, proceeding from Lake Tanganyika, discovered west of that lake and east of Mwero another Mwero into which run the rivers Mkabe, Mwambezi, the Choma from the north, and the Chisela from the north-east. This lake is now partially desiccated, and consists of an extensive salt-marsh with several pools of water, including a large central one about fifteen miles long by ten wide. The former outlet of this lake was by the Movu river-bed to the Kalongwizi River, a feeder of Lake Mwero. Kazembe, the powerful chief who resides on the Luapula, above Lake Mwero, though very polite to the traveller, would not permit him to cross because of his enmity to Mshidi, so that, finding all attempts useless, Mr. Sharpe was compelled to retrace his steps to Abdallah's near the salt-marsh, and from thence to make his way westward round the north of Lake Mwero. Abdallah is an agent of the famous Tippo Tib, and bears sway eastward as far as Kabunda, near Tanganyika. The highest point between Chipenbiri, on the level of the swamp, (3050 feet) and Lake Mwero, is at an elevation of 3850 feet. The eastern watershed of the northern part of Mwero is not more than six to eight miles from the shore, and that lake is 2900 feet above the sea. The streams Luao and Luchinda flow into the lake from the north, and Mpweto's town, east of the Luabula, is subject to Abdallah. The Luapula, at its point of exit from the lake, is of less volume than above. Beyond the lake rises one of those plateaux so frequent in Africa, and the country beyond this, after passing Chuako (subject to Mpweto), belongs to Mshidi. The Luvule River falls into the Luapula not far from its exit, and the next river reached after crossing the watershed is the Luvula, an affluent of the Lufira, into which it falls a few miles above the junction of the Lufira with the Likulwe, from its left bank. The Lufira itself like the Lapula, is a tributary of the Congo. The soil of Garenganze is rich, but the country shadeless. Mshidi is now an old man; originally he was a trader from the Wa-Nyamyezi, but became chief. He has many wives. On his return by the same route

[1]This department is edited by W. W. Lockington, Rugby, England.

that he had entered, Mr. Sharpe explored the salt-swamp, and found it rich in large game. Lake Bangweolo is placed at 4260 feet above sea-level; thus, as the sources of the Chambezi are only 4400 feet, the fall of that river must be very slight. Our traveller states that the practice of maiming the person is rife among the natives southwest of Tanganyika, among whom the Wa-Wemba are perhaps the worst in this respect.

The visitor to Mshidi from the west, was Lieutenant Paul Le Marinel, the service of the Congo State. The route necessitated the crossing of the Sankuru, Lomami, and Lualaba basins. The first is situated further to the east than has before been supposed, and the travellers discovered the Luembe, an affluent of the Lubilash, itself a tributary of the Sankuru. The source of the Lomami was found in 8° 45′ S. and 24° 55′ E. long; the river occupies a long narrow basin, running almost due north and south for 750 miles. During the whole of this course it does not stray more than a degree from a straight course, and it receives only two important tributaries, the Lurimbi and the Lukassi. South of the plateau in which the Lomami rises, is a district named Samba, with a most European aspect. Marinel gives Bunkeia as the name of Mshidi's capital. East of the Lualaba the country is mountainous.

African Notes.—One of the chief discoveries of Dr. Stuhlmann, who last year accompanied Emin Pasha into his old Equatorial province, was the river Kifu, which is stated to have a course of 250 miles before it falls into Lake Albert-Edward, and is thus the most southerly source of the Nile yet known. Dr. Stuhlmann started from Kafure, on the Muta, a tributary of the Kangere, on the west shore of Victoria Nyanza, descended to the Kagere, then crossed the Mpororo Mountains to the Ruchuru and to Lake Albert-Edward (Mwutanzige) at Vichumbi (0° 44′ S., 2850 feet). The country to the south was a vast savannah with mountains in the distance, among which Kisigali, 13,000 feet, seems to be the highest. Beyond this is the active volcano of Virungo Viagongo. Along the west shore of the lake the mountains approach almost to the edge. From Karevia he attempted to ascend the snowy mountain (probably a peak of Ruwenzori), and reached 12,500 feet. He found bamboo and grasses from 3850 to 5350 feet; colocasia beans, grass, and the upper settlements up to 6700; then deciduous forests with Erica and bamboo to 8530 feet, followed by a belt of Erica and Vaccinium to 11,800, above which, to the snow line at 13,000 feet, the vegetation was reduced to mosses, lichens and

Senecio. The plateau west of Lake Albert is known as Lendu. He reports a considerable shrinkage of the waters of the Albert Nyanza since it was first discovered, so that islands have become peninsulas.

M. Crampel and his party was set upon by Snoussi and his fanatical Arabs, who killed all the whites, asserting that they had no business in the country, but did not hurt the Senegalis who composed his escort. M. Nebout, who was coming up, carried back the sad news, and the fate of Crampel was avenged by M. Dybovski, who entered the country with a considerable force.

On the Mobangi, Captain Van Gele has "forged the last link" between that river and the Welle, which is thus definitely included in the Congo basin.

The Kong Mountains of the maps have been found to have no actual existence, proving to be but an elevated watershed.

The Italians are endeavoring to explore Somaliland, but some of their recent expeditions have not been successful. Captain B. de Vesme, however, passed from Berbera by Harrar, over the waterless plains of Milmil to the rivers Kishen and Amaden, and then to the upper course of the Webbe.

America.—THE ECUADORIAN ANDES.—Dr. Wolf, who has devoted much time to the study of the Andes of Ecuador, describes them as consisting of two ranges, connected at intervals by cross chains, and thus enclosing basins. The eastern cordillera is as a whole more prominent, geologically older, and of greater average height than the western, the rocks of which are much more heterogeneous, while its elevation exhibit greater diversity and irregularity. A porphyritic cross ridge at the mountain knot of Acayana and Guagrauina has much gold-bearing quartz, and is the richest mining district of the country. From this the eastern cordillera continues onward, broad and lofty, into the province of Cuenca, with a wide bend, and a second cross ridge of porphyry forms the knots of Portete and Tinajillas. The lofty basin of Cuenca is one of the most beautiful in the Andes, and the chief town is situated at an altitude of 8460 feet. North of there is the irregular mountain mass of Azuay, which sends spurs in every direction, two of which reach the western cordillera. Beyond this the eastern cordillera becomes of greater extent, and rises into the gigantic volcanoes of Sangay (17,880 feet), the most active volcano in the world, Altar, or Collares (17,710 feet), and Tunguragua, (16,696 feet). Opposite to these, on the western cordillera, rises the still loftier Chimborazo (20,660 feet). Here commences a third cordillera, parallel with and

geologically resembling the western range. The waters of the Lacatunga basin flow south and burst through the eastern range. The drainage of the basins of Quito and Ibarra goes to the Pacific. The western cordillera, by the Quito basin, is quite low, not more than 10,000 feet, but is raised by superimposed volcanic rock into the lofty volcanoes of Corazon, (15,804), Atacoza, (14,390) and Pichincha. The eastern cordillera is here more complicated, and bears the giant volcanoes of Cotopaxi (19,480), Sincholagua (16,360), Antisana (18,885) and Cayambe (19,450). Northward the eastern range is continued into Columbia, increasing in height and breadth, but without any volcano north of Cayambe. In the province of Quito the western range rises into the volcanoes of Cotocachi (16,295) and Yanaurai (14,000.)

Both Dr. Wolf and Mr. Whymper describe travelling in the Ecuadorian Andes as depressing in the extreme. The lower regions, up to ten thousand feet, are thickly covered with a forest, within which it rains forever, the home of fever and dysentery. The higher regions are relatively healthy, but past expression dreary, all the more or less rounded heights being covered with coarse brown olive paramo grass, and presenting quite a contrast to the picturesque ruggedness of the Alps. These bleak paramos, as the tracts 10,000 feet or more above the sea are called, are poorly populated and badly tilled, while the huts are windowless and the people in rags. Here and there are fertile valleys with forest in sheltered spots. The temperature has little variety, ranging from 39° to 46°.

Mr. Whymper describes the climate of the paramos as a perpetually wet afternoon, and speaks of Chimborazo as a long extinct volcano, and states that the existing centres of volcanic activity are Cotopaxi and Sangai. The whole of the Andes of Ecuador are, according to Dr. Wolf and Mr. Whymper, situated more to the east than they are shown on Humboldt's and other maps.

THE UCAYALI.—The Ucayali, generally considered the leading affluent of the Amazon, has been found to be navigable for 1040 miles. The junction of the Perene with the Ene forms the Tambo, and that of the Tambo with the Urubamba forms the Ucayali. The Perene, which curves westward toward the Andes, can be navigated ten miles above its junction with the Ene, while the Huallaga, a large tributary to the north, can be entered by large steamers to 100 miles from its mouth. Iquitos, on the Amazon, on the frontiers of Peru and Brazil, is 350 feet above sea level, the mouth of the Ucayali 370, that of the Tambo 800, and that of the Ene 1000 feet. The native population of

the Ucayali Valley, according to Col. Church, is not more than forty thousand, and this is as many as can be supported with their modes of life. Life is not plentiful ; fish are scarce in the waters, and in correlation with this, birds are not abundant. The natives cannot procure iron. The eastern slopes of the Peruvian Andes are clothed with thick forests, among which cinchona trees abound.

Asia.—The Pamirs.—During the last few years much has been written about the Pamir, a region the very name of which was unknown until recently. Many travellers have found their way across this now celebrated plateau, or rather congeries of plateaux, which may be considered to form the western and narrower end of the great Tibetan table-land, the knot, in fact, from which the bounding ranges of that plateau take their origin. Among its late visitors have been the Frenchmen Bonvalot, (in company with the Prince of Orleans), and Sauvergne, the Russian Grombchevsky, the Englishmen Younghusband and St. George Littledale, accompanied by his wife. The main object of the latter seems to have been the destruction of *Ovis poli*, yet they could scarcely avoid adding to our knowledge of this not readily accessible tract.

The Pamir, or rather Pamirs, for there are several, the Little Pamir, the Great Pamir, that of Tagh-dum-bash, Alichur Pamir, and Sarikol, consist of a series of flat valleys surrounded by mountains, the really lofty crests of which do not rise greatly above the level of the valley streams.

The Pamir is situated at the junction of three great empires, and the ownership of the comparatively barren region may lead to war. The lake on the Great Pamir has been named Victoria Lake, but is called by the Kirghis, Gaz Kul, a name also given to two or three other lakes. Victoria Lake is 13,980 feet above sea level, while the Khargash Pass to the north is 14,500 feet, and the Andenin Pass, between it and the Little Pamir, 15,500 feet. The Pamir River from this lake flows west into the Wakhan, which seems also to bear the name of Kala-i-Panj, and which, after its junction with the Murghab, becomes the Amu-Daria or Oxus. The Little Pamir Lake is said to be 13,850 feet above sea level, and its outlet is by the Aksu, which, after running north-east until it has rounded the Great Pamir, unites with the Aik Bailul to form the Murghab affluent of the Oxus, flowing through Roshan Valley. Between the westerly courses of the Wakhan River and the Murghab flows the Ghund-Dara, the chief sources of which seem to be Lake Yashil-Kuhl and the Alichur River—the valley of the Ghund-

Dara is known as Shignan. Littledale's encampment on the Alichur Pamir, was at a height of 13,625 feet. Lake Kara Kul, north of the Akru-Murghab, is 12,400 feet above the sea.

East of the Great and Little Pamirs are Tagh-kum-bash and Sarikol, the streams from which, among them the Markhan-su, flow into the Kashgar and Yarkand Rivers, and thus geographically fall to China, which has, in fact, raised her banner on the Sarikol plateau. The two maps which have been published in the Proc. Roy. Geog. Soc. during the past year exhibit differences in the course of these affluents.

The important range of the Hindu Kush separates the Chitral and Hunza district from the Pamir and more northern valleys. This range is crossed by the extraordinary depression, two to three miles wide, known as the Baroghil Pass (12,480 feet). Through Chitral Valley flows the Yarkhun River, rising in a small lake bearing the title of Gaz Kul, and flowing somewhat south of west toward the Indus. Close to this Gaz Kul, even if not occasionally united with it, is another small lake, from which issues the Karambar River, which with the Gilghit and Hunza Rivers, join the higher course of the Indus, where it flows toward the west, before bursting through the Himalayas. The western part of this Indus-draining region is known as Chitral, and is situated at an average elevation of 5200 feet on the southern slopes of the Hindu Kush, amid spurs from fourteen to twenty-five thousand feet above sea level. On the south it is bounded by the petty States of Asmar and Dir. The valley is reputed to be very fertile, and is said to have a population of a hundred and fifty to two hundred thousand, without reckoning the Bushgali Kafirs. The Mehtar or Badshah of Chitral, is said to be able to bring into the field 6000 fighting men, all careful marksmen. Chitral, about 150 miles from the town of Gilghit, is an aggregation of six large villages situated along the river, which in the Geographical Journal is called the Kashkar. The names Yarkhun and Kashkar seem to be identical with the Yarkana and Kashgar of Chinese Turkistan.

Mr. and Mrs. Littledale reached the Pamir region via the Russian Trans-Caspian railway. The route from Samarkand to Marghilan, the capital of Kokhand, is described as an alternation of barrenness with gardens of Eden. Continuing southward, they followed the Gulcha River and crossed the Alai plateau over the Little Alai range. Through the passes of Taldik (11,600), Shart (12,800), Terek (over 12,000), Kalin Art (10,800) and Kizil Art (14,200), they reached Kara Kul Lake, and then, after encamping within sight of Lake

Yashil Kul, crossed the Great and Little Pamirs, and proceeded through Baroghil Pass to Chitral, Darkot and Yasin, whence they made their way to Gilghit. From the Great Pamir they enjoyed a view of magnificent mountain peaks over 20,000 feet high. They describe the Pamirs as flat valleys, with lakes having low shelving banks; barren areas with little grass. In Chitral the climate was much better, the warmth and the abundance of apricots contrasting sharply with the barren coldness of the Pamirs.

D. W. Freshfield thus speaks of the Pamirs, after stating that the different strips of table-land form a district 280 miles long, from 120 to 140 wide, and twelve thousand feet high, "tent-shaped glacier-covered mountains divided by broad easy gaps, bare heights naked of verdure and shorn of forests by bitter winds and frosts; desolate lakes, a region which for the most part has neither fuel nor food; an Engadine of Asia, with nine months of winter and three months of cold weather; the home of wild sheep and that of a few wandering shepherds; nomads' land if not no man's land." The Chinese name for the district signifies the "half-way house to heaven," while the word "Pamir" appears to be a Turki term for a plateau. Grombchevsky gives a more favorable account of the district. Wakhan, Shignan and Roshan are at present claimed by the Amir of Afghanistan. Mr. Younghusband found his way to Hunza in 1889 and to the Pamirs in 1890. Between Leh and Hunza, or Kanjut, four passes, from 17,500 to 18,500 feet high, must be crossed, amid glaciers and the grandest scenery. The home of the robber Kanjuts, or Hunza, (in which latter name some think to find the origin of the Huns), is eastward of Chitral. The villages of the Hunza are stone-walled forts, the entrance into which would be difficult if resisted. The sovereign, who made his way to power in good old Oriental fashion, by the murder of his relatives, owes allegiance to the Maharaja of Kashmir. The Taga-dumbash Pamir descends as low as to 800 feet.

Another recent traveller in this region is the Frenchman Dauvergne, who entered by Srinagar and Leh, over the Karakoram Pass to Sanju Kurgan, took a new route to the sources of the Oxus, crossed Baroghil Pass into Chitral, and then through unexplored passes found his way into Karambar Valley, and via Gilghit back to Srinagar. Beyond Kilian Pass (17,450), at Namelong, Dauvergne turned west and reached Kugiar Valley by the following passes, Namelong (12,140), Saraghar (13,250), Tuslar Dawan, (14,500), Tupa Dawan (15,400), (a great opening in a chain parallel to the Kuen Lun, not yet marked on the maps, with peaks sixteen to nineteen thousand feet in height); Sanich

Dawan (16,170), and Kichokin Dawan, a double pass, 15,300 feet above sea level. The Tisnaf Valley, Egisarak Kurgan, where copper is found, the village of Langar on the Zarafshan, an affluent of the Yarkand, are other points in his journey. He followed the Zarafshan to its junction with the Tung, and then turned S. S. W. to the plateau region, where he reached 16,350 feet. According to him, the real sources of the Oxus are those of the Panjah. The difficult Karambar Pass was crossed with ten horses.

Australasia.—THE GLACIERS OF SOUTH NEW ZEALAND—The glacier region of the southern island of New Zealand has been to a great extent explored during the last thirty years. The smaller glaciers, which lie north of the larger, were first visited, the earliest visit to the latter being that of Sir J. von Haast in 1862. After his exploration of the headwaters of the Godley and Tasman rivers, came the visit of E. P. Seely between 1867 and 1870. Little more was done until 1882, when the Rev. W. S. Green almost ascended Mt. Cook, the loftiest peak of the region (12,349 feet). Dr. Lendenfeldt followed next year, and ascended Hochstetter Dome (9,258 feet). Since that year many ascents have been made by G. E. Mannering, Dixon, Johnson, Inglis, Brodrick and A. P. Harper, the contributor of a notice to the Royal Geographical Society. From the account and accompanying map it may be gathered that there is a great difference between the conditions, character and scenery of the eastern and western parts of the range. The glaciers of the east slope descend gradually from elevations of 5,300 to 8,600 feet to their terminations, 2,354 to 2,882 feet above the sea; the comparatively flat surface of their ice is hummocky, and for about a quarter of the length of the glaciers is covered with a considerable quantity of rough moraine; the old lateral moraines of these eastern glaciers are also distinct, especially that of the Hooker glacier, where in one part there are no less than five. On the Mackenzie plains terminal and lateral moraines have been followed for forty miles. The glaciers of the east slope have been tolerably well explored; the principal ice sheets are Tasman, 18 miles long, 1.25 to 2.14 wide, and covering 13,664 acres; Murchison, 5,800 acres, and eleven miles in length; Müller, 3,200 acres, and eight miles in length; and Hooker, 2416 acres, and seven and a quarter miles long. North of these lie the Classen glacier of 1,707 acres, 4.70 miles long, and Godley glacier, covering 5,312 acres, extending over eight lineal miles. The Aletsch glacier of Switzerland is fifteen miles by about a mile, and thus is inferior in dimensions to the Tasman glacier.

The western slopes have not yet been thoroughly explored, but it is known that they are subject to a very large rainfall, amounting to about 120 inches against 25 or 30 on the eastern slope. Though Mt. Cook is nearer to the equator than Switzerland, the glaciers descend some 3,000 feet lower than in that country. The Fox glacier, indeed, on the western slope, descends to 700 feet, and one or two others to less than 1,300 feet. These western glaciers are steep ice-falls to a short distance from their terminations, and their surfaces are almost free from moraine stuff—in consequence of the steep dip and smooth surface presented by the rock strata on this face, as compared with the jagged edges on the east slope. The lower parts of the Fox glacier, and of some others on the west, is overhung by tree-ferns and bushes growing almost on the moraine, and near to the terminal face of the Fox issues a hot spring with a temperature of 100°. A phenomenon of the same kind, on a larger scale, occurs at Mount Ruapehu (9,100 feet) in the northern island. This mountain is covered with snow and ice to the summit, where is situated a boiling lake, into which the ice melts.

These glaciers seem on the whole to be receding, especially those at the head of the Rangitata River, but last year the Müller advanced so as to dam up the Hooker River, and the Ball glacier is certainly advancing. The daily rate of flow varies; on the Ball it is from ten to eighteen inches, on the Murchison from 2.6 to 8, on the Hooker very slight, on the Müller from 3 to 12.

In 1890 Mannering and Dixon discovered that the loftiest peak, Mt. Cook, was not situated on the main range, but on its eastern side, so that it sends no water to the west coast. The next most lofty peaks are Dampier (11,823), Tasman (11,475), and a peak which bears no title on the map, though it reaches the altitude of 11,844 feet. There are several other summits that attain above ten thousand feet. The writer states that he has not seen vegetation at above 6,200 feet, and that 6,500 may be considered the highest limit. The flora is not so varied as that of the Swiss Alps.

Europe.—THE CAUCASUS.—The Caucasus still continues to be a favorite region for Alpine exploration by English and other clubs. Mr. D. W. Freshfield, himself an ardent climber, from time to time contributes a note to the Royal Geographical Society. In one of these it is mentioned that new maps show in the central Caucasus one peak over 15,000 feet, nine over 14,000, and five others over 13,000, also that in Suanetia four elevations of more than sixteen thousand feet are known, two over 15,900, three more over 15,000, and three over 14,000.

The Ossete villages, built upon summits, are stated to abound in interesting antiquities.

The Black Sea.—A hydrographical exploration of the Black Sea, recently conducted by the Russian Government, has proved that the waters of that large area exist under anomalous conditions. The 100 fathom line follows the coast outline closely save in the north-west where it crosses with a slight northern inflexion, from Varna to the Crimea. From this the bottom descends at the tolerably steep gradient of twelve degrees to a depth of 800 fathoms, and from thence with a slighter inclination to 1,200 fathoms. The 1,200 fathom line encloses an oval in the center, with 1,219 to 1,227 fathoms as its greatest depths.

The upper stratum of twenty-five fathoms changes in temperature with the seasons; between this and 100 fathoms the coldest water, as low as 44° is found, while below 100 fathoms the constant temperature is 48°. In August the upper surface of the cold layer sinks to from thirty-five to fifty fathoms. The vertical circulation of the water is limited to the upper one hundred fathoms, and there is no trace of organic life below this level. The lower layers contain much sulphuretted hydrogen, besides sulphates of alkaline and earthy metals, yet the principal reason of the absence of life is probably the deficiency of oxygen in a dissolved state. The bottom from ten or twenty to a hundred fathoms is covered with a light gray mud; from 100 to 800 fathoms the mud is dark gray, and at greater depths it assumes a bluish tint through the prevalence of carbonate of lime. Remains of brackish water mussels, of which species some still live in the Caspian, while others inhabit the rivers flowing into the Black Sea, are found at depths of from one to six hundred fathoms. It has been assumed that at the beginning of the Quaternary and end of the Pliocene periods, the Black Sea was a brackish lake, without any communication with the Mediterranean, and that at the end of the glacial period the very salt waters of the Mediterranean bursting in through the newly opened Bosphorus, accumulated at the bottom, prevented circulation, and annihilated the brackish water fauna.

The Mediterranean.—The depths of the eastern Mediterranean have been explored by the Austrian expedition in the *Pola*. A depth of 4,400 metres was found in 35° 44′ 20″ N., and 21° 44′ 50″ E. long., at a distance of only about fifty knots from Cape Matapan. A few miles farther eastward 4,080 metres was found—these are the greatest

known depths in the Mediterranean. Between Candia and Alexandria 3,310 metres was found twenty miles south-east of Grandes Bay, and this depth gradually diminished to the east, to 2,120 metres near Alexandria.

The Polar Regions.—Dr. Nansen's Voyage.—The opening article of the Geographical Journal for this month is a reprint of the address read before the Royal Geographical Society on November 14, 1892, by Dr. Fridtjof Nansen, the adventurous traverser of Greenland, and the daring aspirant to the honor of reaching the North Pole by drifting with the currents.

Of the existence of these currents ample proofs were adduced in the course of Dr. Nansen's speech, but of their sufficiency, their regularity, as well as of the character of the region to be traversed, whether largely open ocean, or whether cut up into intricate channels by a maze of islands, the bold argonaut could not say anything convincing.

As proofs of the general course of the currents, Dr. Nansen stated that ships turned back by floe ice drifting southward were carried between Greenland and Spitzbergen, through which passage he estimated that in every twenty-four hours a startlingly enormous quantity of water passed southward; also that other southward currents ran through Smith, Jones and Lancaster Sounds; and that undoubted relics of the unfortunate Jeannette were picked from a floe at Julianehaab three years after she sank near the New Siberian Islands. He believes the regions around the pole to act like an enormous pump, sucking in the water from Bering's Strait and East Siberia, and returning it by the Greenland Seas. Among other facts, he mentioned that several years ago, a throwing-stick of a peculiar form used only by the natives of Port Clarence, Norton Sound, Alaska, was found near Goathaab on the west coast of Greenland, also that the driftwood which reaches every year the shores of Greenland and Spitzbergen, is the timber of American and Siberian species. At the New Siberian Islands the ice is thin, while on the east coast of Greenland it is thick, and the speaker maintained that it grew in bulk as it drifted across the pole.

Specimens of mud, collected by Nansen from floes between Iceland and Greenland, had been examined by Dr. Tornebohm, of Stockholm, who had come to the conclusion that it consisted of mud from the great Siberian rivers. Dr. Cleve, of Upsala, had also examined the dust from the snow of these floes, and had identified sixteen species of diatoms, all of which were known to be found at Cape Wankarena, near Behring Strait, and twelve of which were only known from there. The pumice

abundantly strewn on some parts of the shores of Norway, Spitzbergen and Greenland, is stated by Bäckström to be andesitic, and must therefore have been derived from some andesitic volcano near Bering Sea—this proves a post glacial communication. A great deal of this pumice is now, probably on account of the rising of the land, at from thirty to seventy feet above sea-level.

In order to guard, as far as possible, against the danger of being crushed in the solid ice, a ship of small size and great strength, yclept the *Fram*, has already been built. She displaces about 600 tons, is large enough to accommodate twelve men with food and fuel for five or six years, and has engines of 160 horse power, enabling her to steam some six knots hourly. The sides slope from bulwarks to keel, so that the pressure of the ice may tend to lift her out of the water (as occurred in the case of the *Tegethoff*); she is broad in proportion to width, pointed at both ends, flat-bottomed near the keel, which is almost covered by the boarding, and has a considerably curved stem. A special point is the arrangement for raising the screw clear out of the water —two reserve screws are to be carried. The sides are planked with pitch-pine, oak, and greenheart to a total thickness of over twenty-eight inches. The length at water-line is 113 feet, and the sailing speed is reckoned at from 8 to 9 knots. The *Fram*, or Forward, was launched at Laurvik, October 28, 1892, and will start on her hazardous cruise in the Spring. She has ten boats of various kinds, including two specially large and strong, intended for the homeward voyage in case the ship should be crushed; a dynamo will also be taken.

The reading of this paper was followed by a long discussion, in which various objections were brought forward by distinguished Arctic navigators. Some of these were successfully answered by Dr. Nansen, who, however, seemed inclined to follow the advice of Captain Wiggins, and to start by way of the Kara Sea, rather than from the New Siberian Islands. Sir George Nares pointed out the danger of disregarding the usual maxim to keep close to shore, and said that several years would be required for the drifting, during the whole of which time the vessel would be in danger. A vessel frozen-in became a solid block with the ice. He accepted the homing current as proven, but doubted the existence of the out-going one, or at least its power to overcome the force of the winds. The largest fresh-water rivers lost all influence at a distance of 200 miles from their mouth. The *Fram*, he said, could not at best expect to reach more than sixty miles north of 76° 30′ before meeting with the ice-pack, and would thus be frozen-in 730 miles from the Pole and 600 from the home current. He believed that

the wind would be more likely to drift the vessel to the west than to the east.

Sir A. Young said that the greatest danger arose from the land. The remains of the Jeannette had probably found their way through narrow channels, in the course of years. He considered the fact that a tame reindeer had once found its way from Siberia to Upernavik, in Greenland, proved the existence of land. The advice of Captain Wiggins was not to wait for a squeeze, but to endeavor to run the vessel on to the top of the ice.

To all these Dr. Nansen answered by a declaration that, as he had abandoned his ships to cross Greenland, so he meant to abandon the coast to reach the Pole; he believed that the winds acted with and caused the currents.

Admiral Sir G. H. Richards, in a written communication states his belief that the enormous ice-cap of the pole, and the weight of snow, cause an outflow in all directions. Solid ice north of 78° is his conception of the Arctic.

Finally Sir J. D. Hooker writes a word of earnest warning. The lines of a ship may be of use in an open pack, but not when forced against land, amongst floes and bergs, or when the vessel is on her beam ends. He then enlarges upon the depressed spirits produced by the long confinement in close quarters, ever in prey to a haunting uncertainty, to say nothing of the risk of scurvy.

General Notes—The Geographical Journal, the first number of which appeared in January, can scarcely be called a new magazine, since it is but the well-known " Proceedings of the Royal Geographical Society " in a new dress, a dress which will, it is hoped, tend to popularize the study of Geography, and thus gain for itself a wider circle of subscribers than was reached by the " Proceedings." One of the most noticeable new features is the more extended reviews of recently issued books, printed in the same type with the principal articles.

Before the outbreak of the war with Chili, a Geographical Society had been founded at Lima, by D. Manuel Pardo. This was broken up by the war, but was again started on April 15th, 1891. The first volume of the " Proceedings " contains much of interest; among other things an article on the phenomenon known as the " Callao Painter," by S. Raimondi, and others on the River Purus, the geology of Huanta, and on the subsidence of Lake Titicaca. The president is

D. Louis Carranza, a physician and a close observer, the secretary of the philologist, G. P. Zegarra.

Among well-known geographers who have passed away during 1892 may be mentioned Bates, the "Naturalist on the Amazon"; Grant, Speke's companion to the sources of the Nile; Lord Arthur Russell, Professor Moseley, and Sir Lewis Pelly, who, while stationed at Bushire, adventurously penetrated in British uniform to the stronghold of the fanatical Wahabis. This was in 1865. At Riyadh he met the blind Saiyid Amir, and was allowed, in appearance, to depart in safety, but on their homeward march the party found that their water-bottles had been poisoned, and suffered agonies of thirst, the only refreshment they could gain being to pour the water over their wrists.

In an address delivered before the Berlin Geographical Society, Professor J. Walther compares the desert regions of America with those of Africa, and finds the similarity greater than is generally supposed. Both are characterized by four distinct types of denudation, gravel beds, sand-dunes, loam regions and salt deposits. In both the mountains rise out of the plains like so many islands, without any intervening debris, and in both the "amphitheatre" formation is common. Both exhibit the denudating powers of heat and dryness, the first splitting the rocks into fragments, while the dry winds whirl the dust into heaps. No doubt water, even here, is the chief agent, but it has not more than sixty days in which to accomplish its work. The chief difference between the American arid lands and those of North Africa is the steppe vegetation of the former.

GEOLOGY AND PALEONTOLOGY.

Geology of Eastern Siberia.—The *Investia* of the East Siberian Geographical Society (Vol. xxiii, 3) contains an account of M. Obrutcheff's further researches in the Olekma and Vitim highlands. In the northeastern part of this region the author found a further continuation of the "Patom plateau"—that is, a swelling from 3500 to 4000 ft. high, devoid of trees, with ridges and mountains rising over it to heights of from 5000 to 5600 feet. They consist of granite and crystalline schists, probably of Laurentian age, covered with younger, probably Huronian, gneisses and schists. The other parts of the highlands consist of Cambrian and Ordovician deposits, while Silurian limestones and Devonian Red sandstones are met with in the Valley of the Lena. We thus have a further confirmation of the hypothesis, according to which the great plateau of northeastern Asia is a remnant of an old continent which has not been submerged since the Devonian epoch. Further traces of mighty glaciation have been found in the southeastern part of the region. As to the gold-bearing deposits, they are pre-glacial in the south and post-glacial in the north. The high terraces in the valleys are indicative of a considerable post-pliocene accumulation of alluvial deposits, and of a subsequent denudation on a large scale. (Nature, Jan. 12, 1893).

Geological Features of Arabia Petræa and Palestine.—At a recent meeting of the London Geological Society, the following communication was read by Professor Edward Hull on the Geology of Arabia Petræa and Palestine:

The most ancient rocks (Archean) are found in the southern portion of the region; they consist of gneissose and schistose masses and are penetrated by numerous intrusive igneous rocks. They are succeeded by the Lower Carboniferous beds of the Sinaitic peninsula and Moabite tableland consisting of bluish limestone with fossils, which have their counterparts chiefly in the Carboniferous limestone of Belgium, and of a purple and reddish sandstone (called by the author "the Desert Sandstone," to distinguish it from the Nubian Sandstone of Cretaceous age), lying below the limestone. The Nubian Sandstone, separated from the Carboniferous by an enormous hiatus in the succession of the formations, is probably of Neocomian or Cenomanian age, and is succeeded by white and gray marls, and limestones with

flint, with fossils of Huronian and Devonian ages. The Middle Eocene (Nummulitic Limestone) beds appear to follow on those of Cretaceous age without a discordance, but there is a real hiatus notwithstanding the apparent conformity, as shown by the complete change of fauna. In Philistia a calcareous sandstone in which no fossils have been discovered is referred to the Upper Eocene; for the Miocene period was a continental one, when faulting and sliding were taking place, and the main physical features were developed—e. g., the formation of the Jordan-Arabah depression is referable to this period.

In Pliocene times a general depression of land took place to about 200–300 feet below the present sea-level, and littoral deposits were formed on the coasts and in the valleys. To this period belong the higher terraces of the Jordan-Arabah valley. The Pliocene deposits consist of shelly gravels. Later terraces were formed at the epoch of the glaciation of the Lebanon Mountains, when the rainfall was excessive in Palestine and Arabia.

The volcanoes of the Jaulân, Hauran, and Arabian Desert are considered to have been in active operation during the Miocene, Pliocene, and Plistocene periods, but the date of their final extinction has not been satisfactorily determined. (Geol. Mag., Jan., 1893).

The Vertebrate Fauna of the Ordovician of Colorado.—Mr. Charles D. Walcott has recently published a paper on the vertebrate fauna in strata of Ordovician age near Canyon City, Colorado, already noticed in THE NATURALIST. The fossils consist of what appear to be the plates and scales of fishes and the ossified chordal sheath of a fish allied to the recent Chimæra. The remains occur in a sandstone which is correlated with the lower Trenton and the lower Bala of Wales. Microscopic sections of a dermal plate belonging to an *Asterolepis*-like form, examined by Dr. Otto Jaekel, show (1) the dentine tubules that are characteristic of vertebrates; (2) the occurrence of true osteoblasts, which exclude the forms from the Elasmobranchii, and relegates them to other low divisions of the fishes; (3) the absence of enamel and the distinct concentric lamination of the dentine tubules which indicate a low stage of development.

In view of the objections that can be made to a classification based entirely upon the characters of the dermal plates and scales Mr. Walcott has made his classification tentative and has only outlined the characters of the fragmentary remains. For the present, then, the fossils will be known respectively as *Dictyorhabdus priscus*, a supposed chimaeroid, and *Astraspis desideratum* and *Eriptychus americanus*,

rhipidopterygians. It is, however, extremely unlikely that these forms are fishes, but they are more likely Agnatha.—Bull. Geol. Soc. Am., Vol. 3, pp. 153–172. C.

The Loess in Southern Russia.—In his notes on Russian Geology Mr. W. F. Hume gives an interesting account of the Russian Loess, its character and distribution, together with a theory of its origin.

The Russian Loess is a yellowish-brown sandy clay, often rich in grains of quartz and mica, and in many places rich in carbonate of lime and humus. In lies unconformably on all the principal formations. To the west of the Dnieper it conceals the broken and contorted gneisses and granites of the Archean axis in S. Ekaterinoslav and the Don Cossack country it covers the shales and sandstones of the Carboniferous, whilst in the more central governments of Kursk, Karkoff, and Tchernigov it overlies the Cretaceous and the whole Tertiary series. Also along a definite line running to the north of these governments it rests upon the Boulder-clays and sands of the Glacial period. From its general appearance Mr. Hume considers the Loess of Russia to be more or less coeval with that of Central and Western Europe, and the paleontological evidence seems to confirm his view.

In discussing the origin of the Loess Mr. Hume calls attention to the relation, pointed out by Professor Suess between the Loess and the Glacial Drift, and gives in detail the theories of Professor Armachevsky and Baron von Richthofen, neither of which is sufficient in itself to account for the distribution of the Loess.

In conclusion the author gives the following statement of the probacle sequence of events:

I. The Loess particles may be originally derived from the finely ground material resulting from the wearing of the subjacent beds by the ice-sheet.

II. The same have been deposited in tundra-like depressions under the influence of slowly moving waters or by the action of rivers in flood.

III. This deposit under more temperate conditions dried up, and was then suitable material for the redistributive action of the wind.—(Geol. Mag., Dec., 1892).

Sources of the Texas Drift.—Mr. Dumble divides the Texas drift area into four districts. First the Trans-Pecos Texas, the valley of the Rio Grande, and the Rio Grande Divide. The origin of this

drift is traceable to the mountainous region of Trans-Pecos Texas, where nearly every variety of pebble can be found in its original location. Second, the country between the Nueces and the Brazos. This region is covered with pebbles, gravel and sand derived from the rocks found in the Central mineral region. Third, from the Brazos to the Sabine, where the gravel is largely made up of ferruginous material which had its origin in the iron-capped hills which cover so large a portion of Eastern Texas. Fourth, the area known as Northwest Texas according to the survey division. The drift of this region came from the hills enclosing the waters under which they were deposited, viz., Wichita Mountains and the mountains of New Mexico.—Trans. Texas Acad. Sci., Vol. i, 1892.

Archean.—According to Mr. H. V. Winchell, Minnesota possesses the greatest iron district known in the world to-day. It lies in the Mesabi range and extends from the Canadian boundary line in a direction a little south of west, beyond the Mississippi River, a distance of 140 miles. The ore on the eastern end is hard, black and magnetite, owing to the heat of the gabbro overflow. In the central and western portions of the range the ore is soft hematite, limonite and geothite. As to the source of the iron, it is believed by Mr. Winchell to be largely the result of oceanic deposition, both chemical and mechanical, and to have been concentrated in its present situations. (Twentieth Ann. Rept. Minn. Geol. Surv., 1892).—Mr. T. R. Struthers advances the theory that the primitive rocks, *i. e.*, granite, were formed by the cooling of the exterior of the globe under the primeval deep. The pressure of the sea at the depth of two miles would be sufficient to account for the structure of granite. This theory explains the features presented by the bedded or stratified granite of the British islands and many other parts of the world. (Geol. Mag., Dec., 1892.)

Paleozoic.—A skull of *Dinichthys intermedius* recently examined by Professor E. W. Claypole supplies details previously unknown regarding the plates of which it is composed. The especial points of interest are the forms of some of the plates and the over and underlap which has not been represented, and some additions to the structure of the upper jaw. (Am. Geol., Oct., 1892.)—Mr. Herbert Bolton reports a triolobite from the Skiddaw slates of the Isle of Man. The specimen belongs to one of two genera, *Asaphus* or *Æglina*, both of which are Ordovician forms. This in connection with the occurrence of two specimens of Palæochorda (an Arenig form) is strong evidence that

the Skiddaw slates are of Llandeilo age. (Geol. Mag., Jan., 1893).—A species of Cyclus from the Coal Measures of Lancashire, England, is described and figured in the Geol. Mag., Jan., 1893, by Dr. Woodward. The fossil is about as large as a shilling and resembles *C. agnotus* H. von Meyer. Mr. Woodward considers it a new species, and names it *Cyclus scottii.*

Mesozoic.—A new crustacean, *Prosopon etheridgei,* from the Cretaceous beds of Queensland is described by Dr. Henry Woodward. This crustacean is closely related to *P. verrucosum* Reuss, and *P. tuberosum,* von Meyer, two Neocomian species from the Cretaceous of Boucheraus, Dept. Jura. It differs from both, however, in several important points. (Proceeds. Linn. Soc. N. S. W., Vol. vii, 1892).—Mr. R. Etheridge reports a new fossil Phyllopod from the Upper Coal Measures of the Newcastle District, N. S. W., belonging to the genus Leaia. This is the second genus of that family known from the whole of Australia. Mr. Etheridge has named the species *Leaia mitchellii* in honor of its discoverer, Mr. Mitchell. (Proceeds. Linn. Soc. N. S. Wales, Vol. vii, 1892).

Cenozoic.—Mr. J. H. Cooke reports finding the jaw of an Arctic bear, *Ursus arctos* in pleistocene strata of Malta. The fossil, consisting of an entire ramus with its canine and molar teeth, was found in a cavern together with bones of elephants, hippopotami, a stag, and a large dog. (Knowledge, Dec. 1, 1892).—According to Baron DeGeer the Pleistocene changes of level in North America as well as in Europe, are closely connected with the local structure of the earth's crust and with the local extension of the glaciations, and that these changes cannot be accounted for by changes in the level of the sea. (Amer. Geol., Jan., 1893).—M. Bureau has described two fossil plants from the Calcaire *grossier parisien.* The first, called by the author *Aralia eocenica,* is represented by an impression of a leaf remarkable for the slender, long petiole. The second, *Monochoria parisiensis,* resembles strongly certain species of living Monochoria found in India, Ceylon, Malay, China and Japan. (Revue Scientifique, Jan., 1893).

MINERALOGY AND PETROGRAPHY.[1]

The Rocks of the Thalhorn.—In the Thalhorn of the Upper Amariner Thal are found a porphyritic granite, between conglomerates composed of gabbro pebbles in a schistose matrix, and also serpentines, massive gabbro, schists, and various contact rocks. Linck[2] gives a good petrographical description of all these, and geological notes of their occurrence. The main granite mass is a portion of the well-known Kamm granite. It is found in dykes and flows, and it varies in its composition and structure from a typical granitite containing two feldspars, through porphyritic granite and syenite to lamprophyric minettes. The unaltered sediments near the eruptive are graywackes. On the contact with the granite the clastics are altered to knotty schists that are predominantly biotite schists flecked with light spots, consisting mainly of quartz and feldspar in micropegmatitic intergrowths, surrounded by biotite. Extreme alteration gives rise to hornstones, of which the writer recognizes several varieties. In these biotite, feldspar, hornblende and micropegmatite are so orientated as to resemble the poicilitic structure of many diabases and other basic rocks. Hornblende is abundant in them as needles scattered through the groundmass and as large phenocrysts. The conglomerates occupy the greater share of the writer's attention. In one group acid pebbles occur in a sandy or clayey matrix of basic detritus, in which biotite, feldspar and hornblende are new products of alteration. A second group includes rocks made up partly of gabbro material. Here the author again recognizes two groups, in one of which diallage and other gabbro constituents are occasionally present in the groundmass, and a second in which gabbro material forms a very large portion, either of the matrix or of the pebbly portion of the rock. In either case the rock is much altered, with the resulting formation of plagioclase and hornblende. The serpentine of the region was originally an olivine-enstatite rock and not a gabbro as has been supposed.

The New Jersey Eleolite-Syenite.—The New Jersey Eleolite-syenite dyke described by Emerson[3] is again studied by Kemp,[4] who

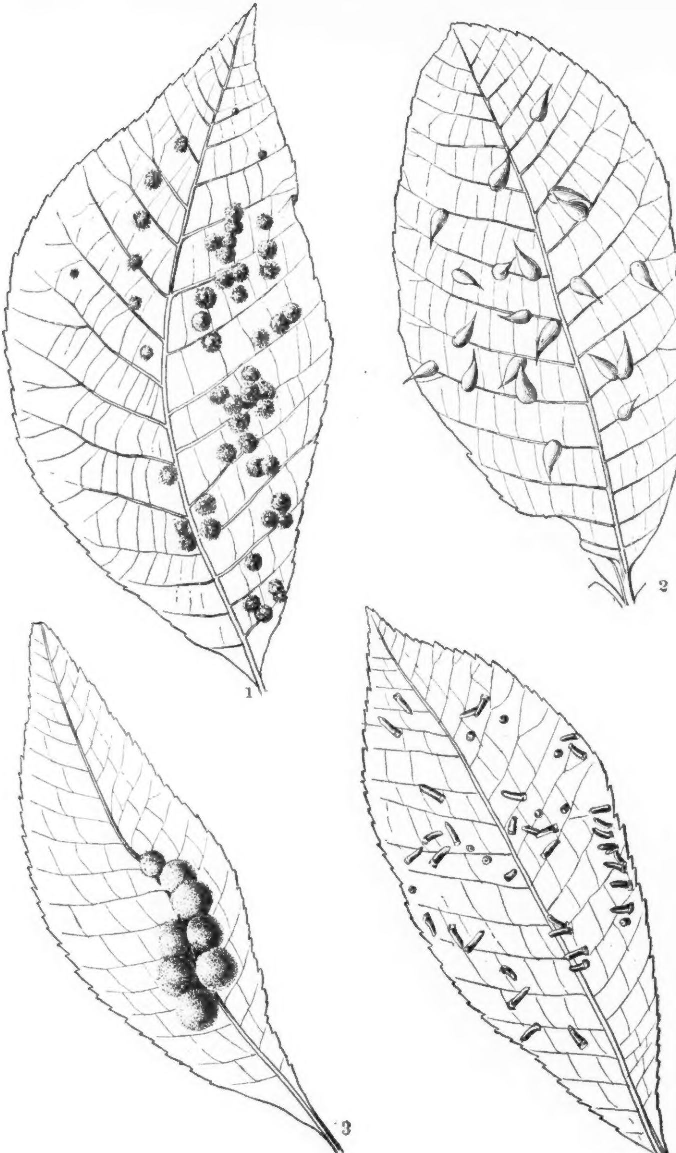
[1]Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2]Mitth. d. geol. Landesanst v. Elsass-Loth., iv, 1892.

[3]Amer. Jour. Science, iii, xxiii, p. 302.

[4]Trans. N. Y. Acad. Sci., Vol. xi, p. 60.

PLATE III.



1. *Cecidomyia holotricha* O. S.
2. *Cecidomyia caryæcola* O. S.
3. *Cecidomyia persicoides* O. S.
4. *Cecidomyia tubicola* O. S.

declares that the earlier description applies only to that phase of the rock occurring in the northern and the southern portions of its extent. The pyroxene throughout the dyke is aegerine. Cancrinite and sodalite are both fairly abundant in it. An analysis of specimens collected from about the point visited by Emerson gave:

SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	MgO	K_2O	Na_2O	Loss	Total
50.36	19.34	6.94	.41	3.43	not det.	7.17	7.64	3.51=	98.80

Eleolite porphyries with a tinguaitic groundmass are closely associated with the more abundant syenite, and along the eastern side of the great dyke are smaller ones of ouachitite and fourchite. The basic material of these small dykes, when first[5] studied, was regarded as porphyrite. Contact effects produced by the intrusion of the syenite through the surrounding shales are noticed on the east side of the dyke, where the sedimentaries have been changed to biotitic hornfels.

Mica Peridotite from Kentucky.—A mica peridotite[6] from a dyke in Crittenden Co., Ky., is composed essentially of biotite, serpentine, and perofskite, with smaller proportions of apatite, muscovite, magnetite, chlorite, calcite, and other secondary products. The biotite and serpentine constitute about 75% of the entire rock. The mica is in large plates in which are scattered the grains and shreds of serpentine. The composition of the rock follows:

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	H_2O	P_2O_5	CO_2
33.84	3.78	5.88	7.04	5.16	9.46	22.96	2.04	.33	7.50	.89	.43

and small quantities of Cr_2O_3, MnO, NiO, CoO, BaO and Cl. The rock represents a new type of peridotite in which biotite takes the part of an amphiboloid in the more usual types.

Rhyolites in Maryland and Penn.—G. H. Williams[7] has identified an extensive series of old volcanic rocks in the South Mountain region of Pennsylvania and Maryland. The rocks have hitherto been considered sedimentaries, but to the writer they exhibit all the peculiarities of eruptives, though some of the beds are fragmental tufas and breccias. The two principal types are rhyolite and basalt. The former possesses all the features of recent eruptives, such as flowage

[5]Amer. Jour. Sci., III, xxxviii, p. 130.

[6]J. S. Diller, Amer. Jour. Sci., xliv, 1892, p. 286.

[7]Ib., xliv, 1892, p. 482.

lines, spherulites, lithophysae and amygdaloidal cavities. Quartz and an alkaline feldspar are the prevailing phenocrysts, while the groundmass is a quartz-feldspar mosaic. The basalts are much altered, but their structure is clearly that of an eruptive. A detailed account of the rocks is promised later.

The Nepheline and Leucite Rocks of Brazil.—A more careful study of a few of the Brazilian nepheline and leucite rocks undertaken by Hussak[8] has resulted in the discovery of leucite in some of the phonolites, and in the detection of leucite-tephrites containing pseudo-crystals. The leucitophyres consist of phenocrysts of sanidine, augite, nepheline and pseudo-leucites in a groundmass of small zeolitized leucites, augite, magnetite and nepheline. The leucite-tephrites are all characterized by the possession of the pseudo-leucites. In many cases these are nothing but spherical masses of the rock material surrounded by biotite plates. In other cases the biotite surrounds analcite or mixtures of analcite and calcite. The structure of several of these rocks is the diabasic. With these the author would place a rock described by Eigel[9] from the Cape Verde Islands, and the augite-porphyrite described by Kemp[10] from Deckertown, N. J., in both of which traces of leucite are thought to have been discovered. Hussak has also found a leucitite dyke in phonolite near Poços de Caldas, and a leucitite tufa composed of fragments of basalt, isolated crystals of leucite changed to analcite, pieces of augite and crystals of magnetite. The author concludes his paper with remarks on 'pseudo-crystals' combating the view of Derby that they are true leucite crystals filled with inclusions of the rock's groundmass.

The last named writer[11] has examined the Peak of Tingua with some care, finding eleolite-syenite, phonolite and dykes of basic rocks. The syenite and phonolite are thought to be phases of the same magma, as they apparently grade into one another. The phonolitic phase occurs both in dykes and in flows associated with phonolite tufas. The origin of the pseudo-crystals is discussed briefly.

Petrographical News.—Brauns[12] has discovered hauyne in the pumice sandstone near Marburg, a mineral hitherto unobserved in the

[8]Neues. Jahrb. f. Min., etc., 1892, II, p. 141.

[9]AMERICAN NATURALST, Feb., 1892, p. 165.

[10]See above under 'The New Jersey Eleolite-Syenite.'

[11]Quart. Jour. Geol. Soc., May, 1891, p. 251.

[12]Zeits. d. deutsch. geol. Gesell., xliv, 1892, p. 149.

rock because of the loss of its characteristic blue color through alteration. The list of minerals common to this rock and to those of the Laacher See is now complete, so that the belief in a common origin for them is rendered almost a certainty.

C. W. Hall[13] gives a few notes on rocks collected from Central Wisconsin, describing very briefly hypersthene and quartz gabbros in which there is much secondary hornblende, and quartz diorites and gneisses regarded as squeezed gabbros.

A fourchite boulder in which are large arfvedsonite phenocrysts is mentioned by Kemp[14] as occurring at Aurora, Cayuga Co., N. Y. The same author mentions the existence of rhyolite, hypersthene, andesite and andalusite-hornstone from near Gold Hill, Toole Co., Utah.

Spherulites[15] of andalusite occur in the carboniferous clastic schists of Beaujeu, France. The schists are composed of black and white mica fragments in a paste of sericite and hematite.

Turner[16] makes brief mention of basaltic, andesitic and rhyolitic lavas, whose source was the late Tertiary cone Mt. Ingalls, in California.

Crystallographic Study of Diopsides.—Some very careful crystallographic observations have been made by A. Schmidt[17] upon the diopsides of the Alathal, of Achmatowsk, of Nordmark, of the Zillerthal and the Arany-Berg. Many crystals from each of these famous localities were examined, and much new data was obtained concerning the mineral. The following new planes were discovered: $4P\bar{2}$ and $5P\frac{5}{3}$ on the white diopside from Achmatowsk; $\frac{11}{5}P\breve{\infty}$ on the green variety from the same place; $\infty P6'$ in the Nordmark species; $\infty P\bar{10}$, $\infty P4'$ and $\infty P\frac{\bar{7}}{5}$ on the nearly colorless small crystals from Schwarzenstein in the Zillerthal, and $\infty P7$ and $P\bar{4}$ on the black Arany-Berg mineral. The form $P4$ appears in Goldschmidt's 'Index,' but no reference to it could be found by the author in the original memoirs. The axial ratios of the different varieties are:

Alathal....................................	1.0895 : 1 : .5894	$\beta = 74°15'47''$
Achmatowsk (white).........	1.0909 : 1 : .5899	$\beta = 74°10'42''$
Achmatowsk (green)...................	1.0951 : 1 : .5985	$\beta = 73°31'8''$

[13] Minn. Ac. Nat. Science, III, No. 2, p. 251.

[14] Trans. N. Y. Acad. Sci., xi, p. 92.

[15] Lévy. Bull. Soc. Franç d. Min., xv, 1892, p. 121.

[16] Amer. Jour. Sci., Dec., 1892, p. 455.

[17] Zeits. f. Kryst., xxi, 1892, p. 1.

Nordmark	1.0915 : 1 : .5848	$\beta = 74°38'59''$
Zillerthal (colorless)	1.0922 : 1 : .5887	$\beta = 74°16'28''$
Arany-Berg (yellow)	1.0945 : 1 : .5918	$\beta = 74°19'38''$
Arany-Berg (black)	1.0913 : 1 : .5875	$\beta = 74°\ 4'53''$

The optical angle for the Nordmark crystals is 2Vna = 60°44′, and $C \wedge c = 45°21'$. For the dark Zillerthal diopside 2Vna = 58°56′ and $C \wedge c = 34°4'$.

Herderite from Hebron, Maine.—A single specimen of Herderite from Hebron, Maine, is described by Wells and Penfield[18] as a few yellowish white crystals on albite. The crystals have a tabular habit, with oP, ∞ P, 3P and $\frac{3}{2}$P the only forms observed. The density is 2.975 and composition:

P_2O_5	BeO	CaO (by diff.)	H_2O	F	Insol.	Total
40.81	15.32	32.54	5.83	.40	5.27	= 100.17

Corresponding to Ca Be (OH) PO_4, or a herderite in which nearly all of the fluorine is replaced by hydroxyl.

Mineralogical Notes—A *calcium carbonate* of secondary origin from the Marble Mountains of Wolmsdorf in Glatz has been analyzed by Kosmann[19] with the following astounding result: Ca CO_3 = 4.32; chemically combined H_2O = 1.54; mechanically combined H_2O = 94.13. The author believes the mineral to be a hydrated carbonate $CaCO_3 + 2H_2O$ capable of absorbing a large quantity of water, similar to the 'Mountain Milk' of Rose.

The *friedelite* of the Manganese mine of Sjogrube, Orebro, Sweden, occurs in large quantity in clefts, veins, etc., that are partially filled with calcite. An analysis yielded Igelström:[20]

SiO_2	Cl	MnO	FeO	CaO	MgO	NaO	H_2O	Total
34.36	3.00	45.88	1.35	1.50	1.50	2.79	9.00	= 99.38

On the *Azurite* from the Laurion Mts., Greece, Zimanyi[21] has found 28 forms, three of which ($\frac{3}{5}$P$\bar{\infty}$, $\frac{4}{3}$P$\bar{\infty}$ and $\frac{5}{3}$P$\bar{\infty}$) are new. The crystals have the usual habit of the mineral, and they compare favorably in beauty with those from Chessy, Arizona and Utah.

[18] Amer. Jour. Sci., xliv, 1892, p. 114.

[19] Zeits. d. deutsch. geol. Ges., xliv, 1892, p. 155.

[20] Zeits. f. Kryst., xxi, p. 92.

[21] Ib., xxi, p. 86.

Tremolite[22] pseudomorphs after sahlite from the limestone of Canaan, Ct., have the composition:

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O
60.98	.10	.12	.19	14.64	23.62	.13	.21

The controversy over the nature of *Melanophlogite* is not yet ended. Bombicci[23] has recently defended himself against the attack of Friedel, and in his defense he accuses his opponent with misquoting him.

New Minerals.—*Ganophyllite*, from Harstige, near Pajsberg, Sweden, is a manganese zeolite[24] that is associated with barite, lead, and rhodonite. It occurs in large brown monoclinic, prismatic crystals, in which ∞P is combined with the base and the clinodome. $a : b : c = .413 : 1 : 1.831$. $\beta = 86°39'$. On cleavage plates parallel to oP a percussion figure may be produced, one of whose rays is parallel to a and the other two inclined at 60° to this. Plane of optical axes is perpendicular to $\infty P\grave{\infty}$, with c the first bisectrix. 2E (air) $= 41°53'$ for sodium light, and $2V = 23°52'$. The pleochroism is strong $c = A$ = yellow-brown; $a = B$ and $b = C$ = colorless. The density is 2.84 and hardness = 4. A mean of two analyses gave Hamberg a result that may be represented by $8SiO_2 Al_2O_3 7MnO + 6H_2O$.'

SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	MgO	PbO(?)	K_2O	Na_2O	H_2O	Total
39.67	7.95	.90	35.15	1.11	.20	.20	2.70	2.18	9.79	= 99.85

Pyrophanite, described by the same author as occurring in the same mine, is a manganese titanium compound isomorphous with ilmenite. An analysis gave:

SiO_2	TiO_2	MnO	Fe_2O_3	Sb_2O_3	Total
1.58	50.49	46.92	1.16	.48	= 100.63

It is found as brilliant, deep red, transparent tables, associated with ganophyllite. $a : c = 1 : 1.369$. The double refraction is strong, and the indices of refraction for sodium light are $\omega = 2.481$, $\epsilon = 2.21$. Density is 4.537.

Synthesis of the Members of the Sodalite Group.—The minerals of the sodalite group have been manufactured by Morozie-

[22] W. H. Hobbs. Amer. Geol., July, 1892, p. 44.

[23] Bull. d. l. Soc. Franç d. Min., xv, p. 144.

[24] Ref. Neues. Jahrb. f. Min., etc., 1892, II, p. 234.

wics[25] as microscopic crystals. A mixture of 65 parts SiO_2 + 3Aq, 44 parts Al_2O_3 + 3Aq, and 33 parts gypsum, heated in a platinum crucible with an excess of Glauber's salt, yielded tiny cubes and dodecahedra of hauyne or sodalite. When heated with an excess of Na_2SO_4 + Na Cl a substance was obtained that is supposed to be an isomorphous mixture of the two minerals above mentioned, and in addition some sodalite crystals were produced. When heated with Na Cl alone sodalite only resulted.

Methods and Instruments.—A simple method for determining the value of the optical angle in thin sections of minerals is described by Lane.[26] It consists essentially of the measurement of the angular distance between the hyperbolas of the biaxial interference figure by means of the sub-stage mirror.

A cheap form of crystal refractometer constructed on the same principles as the larger Zeiss instrument has been made by Czapske.[27] The height of the complete instrument is only 25 cm. It is suitable for all ordinary refraction work.

An Appendix to the "Gems of North America."—Mr. Kunz has issued an appendix to his valuable 'Gems and Precious Stones of North America'[28] that brings the volume up to date. Most of the material in the appended chapter has appeared in the journals, but some of the information it contains is new. The author states that the sapphire gravels of Ruby Bar, Montana, and the turquoise mines of New Mexico are now being worked by companies that expect their outlay of capital justified by a goodly yield of gem material. The turquoise company has already taken from their diggings about a hundred thousand dollars worth of gems.

[25]Neues. Jahrb. f. Min., etc., 1892, II, p. 139.

[26]Science, Dec. 23, 1892, p. 354.

[27]Neues. Jahrb. f. Min., etc., 1892, I, p. 209.

[28]Cf., AMER. NATURALIST, Dec., 1891, p. 1119.

BOTANY.

An International Botanical Congress.—After careful consideration of all the conditions it has been thought advisable to take steps toward securing an International Congress of Botanists in connection with the meeting of the American Association for the Advancement of Science in Madison next August. Upon the return of Professor Underwood from Genoa with his report of what was done there, as well as of what was left undone, such a Congress seemed a necessity, especially when it was learned that the delegates to the Genoa Congress expected one to be held in America this year in order to complete the work left by them. Moreover, the Columbian Exposition will doubtless bring many foreign botanists to this country during the year, and most of these will attend our scientific meetings whenever it is possible to do so. It seems wise, therefore, to take advantage of these favorable conditions and to arrange for a formal Congress.

After a good deal of consultation on the part of those who could more readily do so, it was suggested that the Chairman of the Section of Botany of the American Association for the Advancement of Science and the President of the Botanical Club (Dr. Wilson) should appoint a committee to take the matter in hand. In accordance with this suggestion notices were sent on Dec. 9 to the following gentlemen with the request that they serve on such committee: J. C. Arthur, L. H. Bailey, N. L. Britton, D. H. Campbell, J. M. Coulter, B. T. Galloway, Conway MacMillan, B. L. Robinson, William Trelease, L. M. Underwood, George Vasey.

It is to be hoped that the heartiest support will be given to the committee in their effort to bring to a successful issue the purpose for which they were appointed.—Charles E. Bessey, *Chairman of Section G (Botany), A. A. A. S.*

Botanical Notes.—Mr. B. M. Davis, in the December number of the "Annals of Botany" describes and figures all the stages of development from the carpospore to the young growing plant of *Champia parvula*, one of the common red seaweeds of both the Atlantic and the Pacific coasts. It is a valuable contribution to the embryology of the Florideæ.—A. P. Morgan describes in the "Journal of the Cincinnati Society of Natural History (October) a singular new fungus of the

family Phallaceæ, for which he proposes the generic name *Phallogaster*. It appears to connect the Phallaceæ with the Lycoperdaceæ; in fact it is difficult to say why it may not be placed near the Puff-Balls rather than near the Stink-Horns. The single species is *P. saccatus*. Specimens have been collected in Ohio, New York and Connecticut, showing that it is not local in its distribution.—In the "Contributions from the U. S. National Herbarium," issued in December, 1892, J. M. Holzinger publishes lists of the plants collected by C. S. Sheldon and M. A. Carlton in the Indian Territory in 1891. The novelties are, a variety (*fasciculata*) of *Solidago missouriensis;* a species of trailing morning glory (*Ipomœa carletoni*) with narrowly lanceolate leaves and large flowers (2 to 2½ inches long) which are solitary or occasionally in twos or threes; and a new Euphorbia (*E. strictior*), with very narrow leaves. Dr. Engelmann's *E. polyphylla*, the description of which has hitherto not been published, is here characterized and distinguished from *E. wrightii, E. strictior* and *E. discoidalis*.—In the same publication Mr. Carleton publishes some useful "Observations on the Native Plants of Oklahoma Territory and Adjacent Districts." His observations upon the native grasses are especially valuable.—Mr. B. B. Smyth, of Topeka, Kansas, has published a useful "Check-list of the Plants of Kansas," with especial reference to his proposed distribution of botanical specimens.—The Contributions to American Botany from the Herbarium of Harvard University which the writings of Gray and Watson have made familiar to botanists throughout the world, have been resumed by Dr. B. L. Robinson, the Curator of the Gray Herbarium. His latest contribution consists of Descriptions of New Plants Collected in Mexico by C. C. Pringle in 1890 and 1891, with notes upon a few other species. Among the more notable things is a new genus of Umbelliferæ to which he gives the name *Coulterophytum*, which suggests that the author has taken the hint given by Otto Kuntze in regard to the manufacture of names! *Geissolepis*, a new genus of Compositæ is represented by a single species of prostrate plants from San Luis Potosi.—Dr. Britton, in the Transactions of the N. Y. Academy of Sciences (Nov., 1892), discusses "*Ranunculus repens* and its Eastern North American Allies." He recognizes six species as follows: 1. *R. repens* L., sparingly introduced from Europe; 2. *R. macounii* Hook, Canada and in the Rocky Mountains of U. S.; 3. *R. hispidus* Michx., Ontario to Georgia and west to Michigan, Northwest Territory and apparently to Texas; 4. *R. fascicularis* Muhl., widely distributed; 5. *R. septentrionalis* Poir., eastern Canada to Minnesota, south to Pa. and Ky.; 6. *R. palmatus* Ell., South Carolina, Ga. to Fla.—In a "Prelim-

inary List of American Species of Polygonum" in the *Torrey Bulletin* for December Mr. John K. Small enumerates seventy-nine species. Some changes are made in the nomenclature, and two new species (*P. mexicanum* and *P. pringlei* are described from San Luis Potosi, Mexico.)—"Amherst Trees," by Professor J. E. Humphrey, and "The Woody Plants of Manhattan in their Winter condition," by Professor A. S. Hitchcock, are two pamphlets which indicate the increasing interest in forest trees as constituents of the flora of a locality. The first named is the more popular and treats of many New England trees from the standpoint of the tree lover and the landscape gardener; the second is quite scientific, and is intended to aid the people of the plains (Kansas) to identify trees in their winter state.—A. W. Bennett has published in the "St. Thomas Hospital Reports" (London) a useful paper entitled "Vegetable Growths as Evidence of the Purity or Impurity of Water." He discusses the subject under four heads, as follows: I. Flowering Plants; II. Fungi; III. Algæ; and IV, Characeæ. The presence of the first is "a sign of comparative purity of the water;" of the second of the impurity of the water. The blue-green algæ (*Cyanophyceæ*) "should be regarded as rendering it (the water) unfit for domestic purposes." The chlorophyll-green algæ (*Chlorophyceæ*) are probably innoxious, in spite of the prevalent opinion to the contrary. The Characeæ are regarded as noxious "since when decaying they give off a strong fetid odor, accompanied by evolution of sulphuretted hydrogen gas."

ZOOLOGY.

Allen's Faunal Areas of North America.—In a paper on the Distribution of North American Mammals, Mr. J. A. Allen gives the following tabular synopsis of the faunal areas of North America:

Realms	Arctic.	
	North Temperate.	
	American Tropical.	
Regions	North American.	< North Temperate Realm.
	Central American.	< American Tropical Realm.
	Antillean.	
Subregions	Cold Temperate	=North American Region.
	Warm Temperate	
Provinces	Humid.	=Warm Temperate Region.
	Arid.	
Subprovinces	Appalachian.	=Humid Province.
	Austroriparian.	
	Campestrian.	=Arid Province.
	Sonoran.	
Districts	Great Plains.	=Campestrian Subprovince.
	Great Basin.	
	Pacific Coast.	
Faunæ	Barren Ground.	Arctic.
	Alaskan-Arctic.	
	Aleutian.	Cold Temperate.
	Hudsonian.	
	Canadian.	
	Sitkan.	
	Alleghanian.	Humid Warm Temperate.
	Carolinian.	
	Louisianian.	
	Floridian.	Tropical.
	Tamaulipan.	

(Bull. Am. Mus. Nat. Hist., Dec., 1892.)

The Madagascar Fauna.—At a recent meeting of the Royal Geographical Society, Canon Tristram made the following remarks on the Fauna of Madagascar:

"Madagascar has an extraordinary natural history. One would suppose, from its position, that this would be African, but it, like its people, is thoroughly un-African. The monkeys and lemurs of Madagascar are not to be found in Africa, while all the great African animals of prey are absent. Among the lemurs is one known as the ayeaye, the formation of whose digits is unique. The botany is almost as peculiar.

"We saw, at the last meeting of the Zoological Society, a specimen of the egg of an extinct bird of Madagascar, which is fifteen times the bulk of an ostrich egg, and yet the bird itself does not appear to have been larger than—as far as we can judge from remains—the New Zealand moa, an extinct bird, to which it had an affinity. This same peculiarity runs through all the birds of Madagascar. Of course, the water-birds and sea-fowl are the same as those of Africa, but there are one or two extraordinary exceptions. There is the snake-bird, a long-necked bird of very great beauty and grace, allied to the cormorant, which it resembles in its habits, and of which there are four species in the world—the Madagascar one is certainly Indian. Then, again, another puzzling bird to naturalists is the *Mesites*, a water-hen peculiar to Madagascar. These birds are usually distinguished by a small tail and a short tarsus, whereas, the Madagascar, which is related to the others, has a long tail and tarsus, and no one, until M. Audebert, thought the bird was allied to the rails. There is a group of cuckoos entirely peculiar to Madagascar—the coua—of which there are nine or ten species, which have no relations at all in Africa or India. Then, in another group, we have a bird allied to the thrushes, but not African, although allied to a species in the Mauritius and all the Mascarene Islands—the *Hypsipetes*. Altogether, we cannot explain the Madagascar Fauna, but it shows that Madagascar must have been separated from Africa for an infinity of ages; and its natural history affinities are certainly rather with India than Africa, and yet they are entirely distinct and peculiar. No doubt there is a great deal more to be found out than we have yet obtained. The most peculiar specimens seem to come from the northwest part, which, I believe, has been but slightly explored. We know less of it than of any other part, and that leads one to hope that we may still have further specimens, and that we may get something which will throw light generally on the Madagascar fauna, which is represented also in the Seychelles Islands, in the Rodrigues, and in Réunion, also in the Mauritius." (Proceeds. Roy. Geog. Soc., Nov., 1892.)

The Nephridia of Amphioxus.—Boveri, in an article[1] which deserves more space than we can give it, describes the nephridia of Amphioxus, and, in conclusion, summarises his results in the following words: There are present in Amphioxus all the elements of the nephridial system of the Craniata, part with the same function (pronephric tubules), part in combination with other functions (peribranchial

[1]Zool. Jahrbücher. Abth. f. Anat. u. Ontog. V., 1892.

chamber=pronephric duct), part in wholly other associations (genital chamber=mesonephric tubules). As in the whole of the rest of its organization, Amphioxus, in its urogenital system, shows in contrast with the Craniata, a condition of simplicity and indifference, which is recapitulated by the latter in their ontogeny.

These facts show that we may recognize the conditions of the excretory and sexual apparatus of Amphioxus as primitive from which the relations found in the Craniata have probably developed. Amphioxus is therefore to be taken from its former isolated position, and it shows itself to be, as in all its other organs, so with reference to its urogenital system actually as the primitive type of the vertebrates, as the true primitive vertebrate.

The Position of the Marsipobranchs.—Prof. G. B. Howes has reviewed[2] the various conflicting views as to the systematic position and affinities of the lampreys and hag-fishes, and reconsiders the various structural points of value in that connection. He points out that these forms must be regarded as aberrant gnathostomata; that their urogenital apparatus with that of the Teleosts is the least modified survival of an hermaphroditic apparatus possessed by the ancestors of the vertebrates; that the sucking mouth of these forms has been secondarily acquired, and is not genitically connected with that of the batrachian larva. The arguments from the hypophysis are also considered and assigned great weight, and the rasping tongue is given a greater value in uniting the lampreys and myxinoids than is the sucking mouth. As a result, dismissing, as shown above the term Agnatha for these forms, Howes divides the Vertebrata proper into Epicraniata and Hypocraniata, basing the division upon the position of the hypophysis; the Epicraniata containing only the Marsipobranchs. He has also a secondary division into Euthorchidic and Nephrorchidic series—the lampreys, Teleosts and Dipnoi belonging to the former; all other vertebrates (except, possibly, some ganoids) belonging to the latter series. He thinks that Haeckel's famous aphorism that the Marsipobranchs "are further removed from the fishes than the fishes are from man," fails to express the enormity of the gap between these forms and the higher vertebrates.

Degeneration of the Clitoris.—In a paper read before the American Association of Obstetricians and Gynecologists at the St. Louis, N. W., meeting in 1892, Dr. Robert T. Morris stated that about 80 per cent. of all Aryan American women have adhesions which bind

[2] Trans. Biol. Socy. Liverpool, VI, 1892.

together the glans of the clitoris and its prepuce. These adhesions may bind down the prepuce so closely that not a particle of the glans clitoridis is in sight. They may involve half of the glans, or they may form only a small band. Adhesions which involve the whole, or a large part of the glans clitoridis cause profound disturbances in the physical and mental health of the individual, and probably form the most common single factor in invalidism in young women.

In compiling statistics upon the subject, Dr. Morris found that preputial adhesions are rare among negresses, and seem to occur only in those possessing a large admixture of white blood.

The author considers the degenerate clitoris a characteristic of the civilized white race. (Am. Journ. of Obstetrics, Vol. xxvi, 1892.)

Zoological News—Reptiles.—Professor O. P. Hay has a valuable paper[3] on the breeding habits, eggs, and young of certain snakes, to which reference must be made by all who wish information on this subject. The same author also notes[4] the ejection of blood from the eyes of the horned toad. The same habit on the part of Phrynosoma has been noted by other observers, but Professor Hay has settled, by microscopic examination, the fact that it is really blood which is squirted out from the outer canthus of the eye.

Dr. Oppel, of Freiburg, i.B., deals[5] with the fertilization of the Reptilian Egg. His observations were made upon *Anguis fragilis, Tropidnotus natrix* and *Lacerta viridis.* The article deals with the behavior of the male and female pronuclei and the accessory sperm nucleus, the questions relating to the latter being still left open.

Dr. H. K. Corning, of Prague, deals with some points in the development of the vertebræ and the myotomic cœlom in Anguis and Tropidonotus[6]. The myotomic cœlom persists until after the formation of the neural arches of the vertebræ, hence it is easy to see that the segmentation of the vertebræ results from the formation of inter-vertebral splittings which correspond in position to the divisions between the primitive myotomes. The whole question of resegmentation of the vertebral column is not, says Corning, so simple as has been thought.

The subject of Variation in the snakes of North America, treated of by Cope in a late paper,[7] is taken up by Hay, in his Presi-

[3]Proc. U. S. Nat. Mus. XV., 385, 1892; cf. Proc. Ind. Acad. Sci., 1891, p. 109, 1892.

[4]L.c., p. 375.

[5]Archiv. f. mikr. Anat. xxxix., 215., 1892.

[6]Morph. Jahrbuch., xvii., p. 611, 1892.

[7]Proc. U. S. Nat. Mus., xiv., 589, 1892.

dential address before the Indiana Academy of Science,[8] where he finds in four species of snakes that in *Eutaenia sirtalis* the variation from the average number of body vertebræ amounts to 14 per cent., in *Bascanion constrictor* to 6 per cent., in *Cyclophis vernalis* to 4.5 per cent., and in *Diadophis punctatus* to 13 per cent. In the caudal vertebræ the variations amount to 35, 20, 23, and 23.5 per cent. respectively, while in proportion of tail to body the per cents are 9.4, 28, 25, and 35. Hay states that were breeders interested, they could very soon produce breeds of snakes with long bodies and short tails, and short bodies and long tails, or any other combinations that might be desired. The same author has also some interesting notes[9] upon the systematic names and the habits of the species of *Malaclemys*.

A. J. Bigney notes[10] the occurrence of *Elaps fulvus* in Ripley County (south eastern) Indiana.

Some observations on the growth of the rattle of the rattlesnake are given by Dr. Feokistow, who studied specimens sent him from America. He finds[11] that the rattle is frequently shed, and (his snakes were kept in a very warm room) in three or four months two rattles were present, and that their formation has nothing to do with ecdysis. The snakes were made to register the vibrations of the rattle on smoked paper, and it was found that the vibration was a compound one, consisting of the vibration of the tail as a whole, and of the rattle independently of the tail vibrations. The approximate figures of vibrations are given for the tail seventy-five, of the rattle one hundred and ten per "minute."

Mr. W. E. Taylor has published a paper on the Snakes of Nebraska, giving descriptions of both the adult and the young of every species found in Nebraska, together with remarks upon their habits and peculiarities. (Rept. State Board Agric., 1891.)

At the November meeting of the London Zoological Society, Dr. Gunther read a paper descriptive of a collection of reptiles and Batrachians from Nyassa land, transmitted by Mr. Johnston, containing examples of several remarkable new species, amongst which were three new Chameleons, proposed to be called *Chameleon isabellinus*, *Rhampholeon platyceps*, and *R. brachyurus*. (Nature, Nov. 17, 1892.)

[8] Proc. Ind. Acad., 1891, p. 37.

[9] Proc. U. S. Nat. Mus. xv., 1892. Cf. Proc. Ind. Acad. Sci., 1891.

[10] Proc. Ind. Acad. Sci., 1891, p. 151, 1892.

[11] Mélanges Biolog. Acad. Imp. St. Petersburg, xiii. Translated in Annals and Mag. Nat. Hist. vi, xi, 54, 1893.

Batrachia—Mr. Stejneger reports a blind Salamander from Rock House Cave, Missouri. This is one of the most interesting herpetological events of recent years, since it is the first and only blind form among the true salamanders. Mr. Stejneger considers it a new genus of the family Desmognathidæ, and gives a preliminary description of it under the name *Typhlotrition spelæus*, in the Proceeds. U. S. Natl. Mus., Vol. XV.

EMBRYOLOGY.

The Star-fish Larva.—Dr. G. W. Field[1] has published a fully illustrated study of the development of our common star-fish obtained at the U. S. Fish Commission Laboratory, at Woods Holl, Mass. Special attention was directed to the mesenchyme, mesodermal pouches, ciliated bands and watervascular system of the larva with a view to, solving the meaning of the echinoderm larva.

The two symmetrically placed outgrowths of the archenteron acquire connection with the exterior by uniting with two dorsal ectodermal invaginations. These invaginations form two water pores, which are both open for awhile. The one on the right closes up. This double condition is not, as has been maintained, an abnormal condition, but as Professor W. K. Brooks showed, a normal and significant fact.

In discussing the application of these and other facts to the phyllogeny of the Echinoderms, the author holds that–"the Echinoderm ancestor was probably a free-swimming animal, in general characters not far removed from the ancestors of the Turbellarians; a creature with a well-differentiated digestive tract, ciliary locomotor apparatus, excretory system, respiratory surface not localized; cœnogenetrically modified by the acquirement of transparency, long arms and particularly by modification of the external form, by changes in the direction of the ciliated bands, as pointed out by Johannes Müller, into the forms characteristic for the various Echinoderm groups."

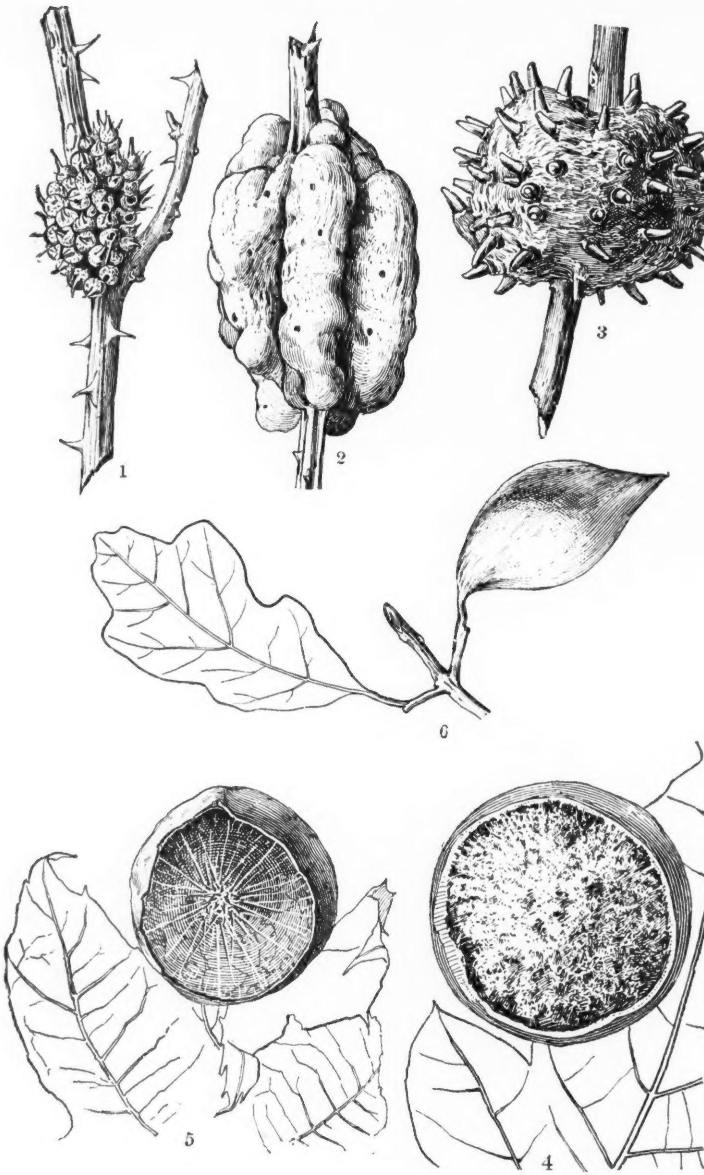
Germ-layers of Amphioxus.[2]—Basilius Lwoff has recently published a short paper in which he gives the results of his observations on the early stages of Amphioxus so far as they differ from those arrived at by Hatschek.

He finds that there is no period of rest at the end of the cleavage, at least as far as the smaller ectoblastic cells are concerned, for they continue to divide frequently. This causes a change in the relative position of the cells at the boundary between the micromeres and macromeres, and results in the passive invagination of the entoblast, ectoblastic cells being the active agents.

[1]Q. J. Mic. Sci. 1892.

[2]Biol. Centralblatt, 12, 1892, pp. 729-744, 8 figs.

PLATE IV.



1. *Diastrophus cuscutæformis* O. S.
2. *Diastrophus nebulosus* O. S.
3. *Andricus cornigerus* O. S.
4. *Amphibolips confluentus* HARR.
5. *Amphibolips inanis* O. S.
6. *Amphibolips ilicifoliæ* BASS.

This multiplication of the entoblastic cells is not equal on all sides, however, but is most frequent on the dorsal side of the invagination; so that the ectoblast becomes invaginated itself at this point and pushing the entoblast before it finally forms the roof of the cavity, while the sides and floor are lined by entoblast. At the same time the margin grows backward and the gastrula mouth gradually closes. In this invagination, then we have two distinct processes: first, the invagination of the entoblastic cells from which the gut is formed, (it is a palingenetic process—the gastrulation); second, the invagination of the dorsal ectoblastic cells; this is to be regarded as a cœnogenetic process, that has nothing to go with gastrulation, but is preparatory to the formation of the chorda and the mesoblast.

Lwoff was unable to find the pole cells of the mesoblast described by Hatschek, and it is interesting to note that more recent observations by E. B. Wilson have had the same result. Lwoff points out, moreover, that even if these cells did exist they could have no connection with the mesoblastic bands; the latter are upon the opposite side from the position assigned to the former.

The multiplication of the cells in the medullary plate causes it to fold inward along the median, and it pushes before it the dorsal wall of the archenteron, leaving a mesoblastic fold on each side. The mesoblast is purely passive in its evagination. The inner half of each fold is composed of ectoblast cells from the roof of the gastrula cavity, and the outer half of entoblast from the side.

The lumen disappears in each mesoblastic segment after it has been constricted off from the general fold. Afterward the true mesoblastic cavity, which is to become the body-cavity, is formed by the separation of the cells in the process of their growth. The body-cavity, therefore, is not a true enterocoel.

The chorda is formed from what is left of the ectoblast in the gastrula cavity, aided, perhaps, by the entoblast at the anterior end. The chordal plate becomes folded outward, and the two sides of the fold are pushed together by the entoblastic cells that at this stage are multiplying rapidly to form the dorsal wall of the gut.

R. P. B.

Epigenesis.—In an interesting review of the history of Evolution versus Epigenesis, Prof. C. Hertwig[3] contributes a few experiments upon the eggs of Triton, to those of Chabry, Fiedler, Driesch and others all tending to overthrow the position occupied by Roux and

[3]Entwichlungs-Theorieen, Berlin, 1892.

Watase regarding the pre-formation and early localization of embryonic organs. While Roux held that the frog's egg is a mosaic in which definite regions must become certain organs, the following experiment of O. Hertwig seems to show that this is unlikely in the related form, the Triton.

When the egg of *Triton palmatus and T. cristatus* taken in May and June 1892 was dividing into two cells, a delicate silk thread was passed around it and drawn together so as to gently squeeze the two first cells somewhat apart. This made the egg somewhat dumb-bell shaped.

Each cell divided and finally an embryo with chorda, somites and nerve tube was formed. As the embryo was not formed so as to lie with its left on one of the hemispheroid parts of the egg and its right upon the other, we may conclude that the first cleavage did not divide the Triton egg so as to separate its right-forming from its left-forming material. The right and left halves are not separated by the first cleavage. In fact in one case the thread separated the head from the tail region.

It is only, the author thinks, by understanding the multiplication of the egg as an organism and the gradual interaction of the numerous cells of any stage that we can arrive at a true conception of the epigenesis-like formation of an embryo.

Form and Chemical Composition.—Curt Hebst[1] of Zurich has published a series of experiments made at Naples and at Triest in the endeavor to determine if the form of organic structures is dependent upon their chemical composition. To this end the eggs of sea urchins, (three species were tried), were reared in sea water to which definite, small amounts of certain salts were added. The salts used were LI Cl, Li Br, LiI, Li NO_3, Li_2 SO_4, Na Br, NaI, Na_2 SO_4, Na NO_3, K Cl, KBr, KI, K NO_3, K_2, SO_4, RhCl, CsCl, Mg SO_4 and Ca Cl_2; the results obtained were certain peculiar forms of larvæ, and the explanation adopted for the results was that the salts acted osmotically, not by altering the chemical constitution of the eggs.

Before speaking of the character of the larvæ reared under these abnormal conditions we will first note a few incidental results sometimes seen. One is that in a number of eggs, two blastulæ were seen inside the egg membrane so that separate twins had been formed from one egg. Again it was sometimes observed that only part of the cleavage cells formed the blastula, the rest remaining as an irregular mass within the

[1]Zeit. f. wiss. zool. 55, Dec., 1892.

same egg membrane. These facts favor the views of Driesch as to the equality of the cleavage cells in the echinoderm. Another peculiar result sometimes followed the addition of salts, namely, the production of twin gastrulæ or plutei (without processes) or even of multiple larvæ all to be regarded in these cases as due to *fusion*. The author entertains no doubt, that by some change in the character of the ectoderm cells the larvæ first adhere and then fuse till there are formed complete twins with two separate mouths, ani and (incomplete) skeletal systems, though but a single body space.

Coming to the main results of the experiments, we find that two peculiar larval forms, the *potassium larvæ and the lithium larvæ* may be formed instead of the normal larvæ when salts of potassium or of lithium are added to sea water.

The potassium larva is simply a pluteus with its normal digestive tract and cilia but without the characteristic pluteus processes or arms and with little or no skeleton. As an example of the amount of material necessary to effect this result may be cited one experiment in which eggs fertilized in normal sea water were put into 860 ccm. sea-water diluted by 140 cm. of 3.7% KNO_3 solution. The larvæ lived for fourteen days but had scarcely any or no skeleton and no arms.

The absence of the skeleton is regarded as the chief thing determining the absence of the pluteus arms; these, it is believed, naturally growing as they are constantly stimulated by the growing skeleton. The cells to form the skeleton may be properly arranged, but do not secrete the lime salts to form the skeleton.

This kind of larva may be formed by other salts than those containing potassium. The lithium larva, however, is formed only by salts containing lithium.

This latter form may be described as two vesicles attached to one another by a hollow stalk. One vesicle has a thicker wall and finer cilia on its outside, the other a thin wall and fewer, longer cilia on its outside. This larva is actually formed by the elongation of a normal blastula followed by a partial abstriction into two vesicular portions.

It is regarded, however, as having the morphological value of a gastrula which has grown in an evaginated form so that the thicker walled vesicle represents the entoderm and the other the ectoderm.

One experiment taken at random will serve to illustrate the amount of salts used; to 1950 ccm. sea-water 50 cm. 3.7% LI Cl solution were added; the characteristic double vesicle larva were formed, but all died on the eighth day.

Most interesting differences obtain amongst the various salts of lithium in the strength of their action. If the eggs of the same sea urchin are treated simultaneously with the various salts we find that at a given time the larvæ were not all equally far advanced, equal amounts of the some salts acting sooner than others in producing the lithium larva, and larger amounts of some salts being necessary to produce the same results as smaller amounts of other salts of lithium.

From a table of such experiment the author concludes that Li Cl, Li NO_3, Li Br, and LiI are less and less active in this order which is also the order of increasing molecular weights. .Thus in these experiments where the same per centage of salts was always used the heavy molecules were less numerous and less active; the action of these salts in producing the lithium larva diminishes with the number of molecules used. This rule, however, finds an exception in $Li_2 SO_4$.

In Na Cl, Na NO_3, Na Br, and Na I as well as in K Cl, K NO_3, K Br and KI we find again the same rule; the larger number of molecules being most efficient in forming the so-called potassium larvæ, and so on down to the heaviest. The results hold only for salts of the same metal.

Now since it is known from the work of H. De Vries and others that osmotic pressure is associated with the number of molecules in a given volume, increasing with diminishing molecular weight we find so close a similarity between the effects of salt upon larvæ and their osmotic action, that we may conclude, the author thinks, that these effects are due to their osmotic action.

Thus the potassium larva is to be regarded as the result of disturbing those chemical processes which would have normally formed a lime skeleton, and this disturbance is by the removal of water osmotically. Again the lithium larva may be regarded as due to some peculiar impermeability of sea urchin larval cells toward salt of lithium; this produces strong osmotic pressure. The pressure is not regarded as working in a gross mechanical way, but rather as a stimulus that causes the larval cells to grow in an abnormal way.

Though this explanation leaves no room for chemical changes as a source of change of form in these echinoderm experiments, yet the author is inclined to think that in some cases, as in the formation of galls, chemical changes of the protoplasm may cause the changed form that results.

The application of this study in experimental embryology is that the normal course of ontogeny is dependent upon the conditions of osmotic pressure within and without the body.

ENTOMOLOGY.[1]

The Pear-Tree Psylla.—During the last two or three seasons many pear orchards in Connecticut, New York and other States have suffered severely by the attacks of a small jumping plant louse of the family Psyllidæ. This insect is supposed to have been imported from Europe early in the present century, having been first noticed in Connecticut. It now occurs throughout many of the Northeastern United States, and as far west as the Mississippi Valley.

In a recent discussion of this insect in Bulletin 44 of the Cornell University Experiment Station, Mr. Mark V. Slingerland records one of the most notable pieces of entomological work done since the establishment of the stations. After an introductory paragraph indicating the recent losses due to the pest the author considers its past history in America; its place in zoological classification; the indications of its presence; the appearance of the immature and mature insect; its life history in detail, and the methods of preventing its ravages, all of which is followed by a series of technical descriptions and a full bibliography. One of the interesting points brought out is that the species is dimorphic, the summer form having been described as one species, and the winter form as another. Concerning this the author writes:

"This difference between the summer and the winter adults is common among the *Psyllidæ,* and has before led to their being described as different species. It seems not to have been suspected that these insects were truly dimorphic or appeared in two distinct forms during the year. The general impression seems to have been that the adults appearing in the fall were at first the same as the summer form; and that as winter approached these adults gradually assumed the characteristics of the hibernating form. However, frequent observations upon *Psylla pyricola* in the field during August and September, 1892, have shown that from eggs lain about August 20th by typical summer adults, there hatched nymphs which showed no variations from the typical summer nymphs and from these nymphs there emerged about September 25th the distinct hibernating form *simulans.* The hibernating forms feed until the leaves fall and then seek their hiding places in which to pass the winter. None have been seen to copulate in the fall. But very few summer forms were seen after September 20th.

[1]Edited by Clarence M. Weed, Hanover, N. H.

Thus in our Pear-tree Psylla we have a case of true dimorphism. The summer form is the typical *Psylla pyricola,* and may be designated when necessary to refer to this form alone as *Psylla pyricola pyricola;* while the hibernating form should be known as *Psylla pyricola simulans.*"

Experiments showed that the immature stages of the Psylla were easily destroyed by spraying with kerosene emulsion. We are indebted to Mr. Slingerland for the use of the engravings on the accompanying plate, showing the stages and structure of the insect. Fig. 1 represents the adult insect; fig. 2, its head and antenna greatly magnified: 3, the abdomen of the male; 4, the abdomen of the female; 5, the wings; 6, the full-grown nymph, and 7, the egg.

Insects of Southern Alaska.—An important contribution to our knowledge of the coleopterous fauna of Southern Alaska has recently been made by Mr. H. F. Wickham,[2] who has published some of the results of a collecting trip made during the summer of 1891. The points visited were Fort Wrangel, mainland near Wrangel Island, Yes Bay, Loring, Hunter's Bay and Port Chester in Alaska, and the Stikine River Valley and Glenora in British Columbia. From his studies Mr. Wickham concludes (1) "That the fauna of Southern Alaska is less closely related to our alpine, northern inland or northeast coast faunæ than is that of the Stikine Canyon or of Glenora. (2) That the Stikine Canyon fauna is more closely allied to that of the north and east than is that of the coast, and about the same as is that of Glenora. (3) That the chief relations of all three are in the direction of Lake Superior. With larger lists this affinity might turn to the Rocky Mountains, especially in the case of Glenora."

Notes on Ohio and Other Phalangiidæ.—A recent study of a large collection of harvest-spiders (*Phalangiidæ*) from all parts of Ohio shows that the State is unusually rich in these interesting Arachnids. The following species occurred in the collection:

1. *Liobunum vittatum* (Say) Weed.
2. *Liobunum vittatum dorsatum* (Say) Weed.
3. *Liobunum nigripalpis* (Wood) Weed.
4. *Liobunum nigripes* Weed.
5. *Liobunum politum* Weed.
6. *Liobunum longipes* Weed.

[2]Entomology of Southern Alaska, Bull. Nat. Hist. Labrt. Iowa State Univ., V. ii, pp. 202–233.

7. *Liobunum ventricosum* (Wood) Weed.
8. *Liobunum bicolor* (Wood) Weed.
9. *Liobonum* (?) *calcar* (Wood) Weed.
10. *Liobunum maculosum* (Wood) Weed.
11. *Liobunum grande* (Say) Weed.
12. *Liobunum grande* var. *simile* Weed.
13. *Mitopus pictus* (Wood) Weed.
14. *Mitopus ohioensis* Weed.
15. *Phalangium cinereum* Wood.

An examination of more than fifty specimens of a harvest-spider in various stages of development taken along the banks of the Maumee River in Henry County, leads to the conclusion that the form from Illinois described some years ago as *Liobunum elegans* is an immature stage of the male of *L. bicolor.* A reexamination of the type specimen of *Mitopus ohioensis* after it has been in alcohol more than four years shows that it was apparently just ready to moult when captured. This gives rise to the suspicion that this is an immature form of *M. pictus*, the pink coloring possibly being due to the peculiar conditions of the moulting period.

The study and measurement of a considerable number of specimens of *Liobunum ventricosum* from many States shows that this species increases in size to the southward in a way similar to that of *L. vittatum.* The southern form is evidently sufficiently distinct for a subspecific name, and as the form now standing as *Forbesium hyemale* is pretty certainly an immature stage of it, the subspecies may well take its name and be known as *L. ventricosum hyemale.*

Illustrated papers on both these subjects are ready for the printer, and will appear in the near future.

Professor C. H. Tyler Townsend, of the New Mexico Agricultural College, recently sent me specimens of an undescribed species of Liobunum taken at Las Cruçes. It may be called *L. townsendii.* Its description is as follows:

Male.—Body 5 mm. long, 3.7 mm. wide; palpi, 5 mm. long. Legs, first, 43 mm.; second, 80 mm.; third, 45 mm.; fourth, 59 mm. General color of dorsum brown, approaching raw umber, with indistinct darker blotches, but no central marking. Ventrum light grayish brown. Palpi similar in color to ventrum, with dorsal surface of patella and of tip of femur darker brown. General color of legs raw umber, with whitish rings near articulations and blackish ones at articulations. Dorsum minutely tuberculate; articulation of the three posterior segments very distinct. Eye eminence rather high, nearly

square as seen from above; canaliculate; smooth except for two sparse rows of spinose hairs. Palpi rather long, slender, with no projecting angles; clothed with rather short hairs and a few minute spinose tubercles; claw slightly pectinate near base. Mandibles normal; light brown with tips of claws black. Femora angular. Second legs much more slender than others.

Female.—Body 7 mm. long, 5 mm. wide; palpi 4.5 mm. long. Legs, first, 35 mm.; second, 61 mm.; third, 37 mm.; fourth, 46 mm. Differs from the male chiefly by its larger body and shorter legs.

Described from three specimens (1 ♂ 2 ♀).—CLARENCE M. WEED.

Gall-Producing Insects.—Mr. Wm. Beutenmüller, of the American Museum of Natural History, publishes[3] a useful Catalogue of Gall-producing Insects found within fifty miles of New York City. Eighty-eight species are enumerated, the family distribution of which is: Cynipidæ, 40; Tenthredinidæ, 2; Cecidomyidæ, 32; Tripetidæ, 2; Psyllidæ, 5; Aphididæ, 6; Acaroidea, 1. The next to the last family is called Aphidæ instead of the more correct Aphididæ. "The vegetable deformations called galls," writes Mr. Beutenmüller, are produced by insects. Generally an egg is inserted in a bud, a leaf, a root, or some other part of the plant, and the presence of this foreign body among the vegetable cells causes an abnormal growth of a definite shape. The variety of galls in respect to texture and substance is very great. Every species of gall-producing insects attacks its own particular plant, and a particular part of that plant, and produces a gall of a definite and uniform structure." The two plates accompanying (due to the courtesy of the author) show a variety of common galls. Plate (III) represents those made by the minute two-winged flies of the genus Cadomyia; and (IV) those made by the four-winged flies of the family Cynipidæ.

Recent Publications.—Mr. Henry G. Hubbard publishes[4] an extended description of the larva of *Amphizoa lecontei*, illustrated by an admirable plate. He extends Schiödte's table of the larval characters of the principal families of adephagous coleoptera.

Through the cooperation of the Massachusetts Society for Promoting Agriculture, the Hatch Experiment Station of the Agricultural College has issued an edition of 45,000 copies of a bulletin concerning canker-worms, tent caterpillars, fall web-worms and tussock moths

[3] Bull. Am. Mus. Nat. Hist., V. iv, Art. xv.

[4] Proc. Ent. Soc. Wash., ii, pp. 341–346.

written by Professor C. H. Fernald. A special attempt is being made to induce the people of the State to suppress these pests. The author states that "There has been such culpable negligence on the part of many of our people with regard to the tent caterpillar that there can be no doubt that some legislation is needed to compel the negligent to destroy this pest on all the trees on their own land, and thus prevent it from extending to the trees in the surrounding orchards. Provision should be made for the destruction of tent caterpillars on all public lands as well as in the forests, and village improvement societies should urge such action in town meetings as shall make it the duty of the superintendent of roads to destroy all tent caterpillars on the trees and shrubs along the sides of the roads."

Mr. S. H. Scudder's Monograph of the Orthopteran Genus Hippiscus which has been running through *Psyche* for some time has been issued as a reprint. The thirty-eight species are grouped under the subgenera Hippiscus, Sticthippus, and Xanthippus.

Two interesting papers on the Butterflies and Crickets of Indiana have been published by Mr. W. S. Blatchley, of the Terre Haute High School. The former is extracted from the 17th Report on the Geology and Natural History of Indiana, and the latter from the Proceedings of the Indiana Academy of Science, 1891.

Mr. Wm. Beutenmüller records in the Bulletin of the American Museum of Natural History (v. IV, Art. XIII) an important List of Types of Lepidoptera in the Edwards Collection of Insects. This collection (made by the late Henry Edwards) "consists of about 250,000 specimens and about 25,000 species, representing all the orders and gathered in various parts of the globe. It is especially rich in Australian species and in North American species from the Pacific Coast. The present list enumerates 465 types of species.

The department of entomology of the University of Kansas has recently published a bulletin of 126 pages concerning "Common Injurious Insects of Kansas," prepared by Vernon L. Kellogg. The paper is well illustrated and will prove valuable to Kansas farmers.

PSYCHOLOGY.

The Sense of Taste in a Sea-Anemone.—It is a well known fact that sea-anemones possess a faculty which enables them to recognize food. This sense has been recently studied by M. Nagel of the Zoological Station at Naples. The following is one of his experiments. A small piece of sardine was gently pushed toward the tentacles of a sea-anemone; the morsel was first touched, then seized, then swallowed. A small ball of blotting-paper, similar in appearance, saturated with sea-water was next offered, but it was not taken. The paper was then saturated with the juice of the fish, when it was seized with the same avidity as the bit of sardine, but often it was rejected after the lapse of a few moments.

When the blotting-paper is impregnated with quinine the tentacles recoil. The quinine does not affect the external surface of the body, except the part situated between the tentacles and the mouth. If food is placed in the mouth, or near the open mouth, the animal does not notice it, but will only take it when the tentacles have touched it. The sense of taste, then, is localized in the tentacles, which serve as organs of touch; and also appreciate changes of temperature. (Revue Scientifique, Dec. 1892.)

M. Vaillant on the Feeding of Snakes.—In a paper read before the *Academie des Sciences de Paris,* M. Léon Vaillant made the following interesting remarks concerning the alimentation of Snakes. These remarks were the result of a series of observations of a large Anaconda from South America, *Eunectes murinus,* one of the Boidae, about 6 meters long, which, contrary to the usual habits of this species accepted food very soon after its arrival at the menagerie of the Reptiles of the Museum, and has continued to eat with regularity up to the present time. In fact, since its entrance into the Jardin des Plantes, August 8, 1885, until the end of the year 1891, this serpent has eaten 34 times, or about 5 times a year. Its food has generally been small or young goats; three times it took a hare and once a goose. The intervals between the times of feeding have varied from 23 days to 204 days; this last interval occurred but once. The snake decided for itself the time for feeding, manifesting its desire by increased activity, and by other signs.

As to quantity of food, in order to avoid all accidents which might result from indigestion, the Anaconda was given animals of moderate size; the largest it has swallowed is a kid of about 12 kilograms weight; which represents one sixth the weight of the snake. There is no doubt, however, that in a wild state, a snake of its size could swallow animals three or four times as large.

M. Vaillant adds, in this connection, the following fact which shows the stretching capacity of certain snakes. In the menagerie of the museum, a viper from France, (*Pelias berus*) had to be put in the same cage with a horned viper, (*Cerastes.*) As the individuals, although they belonged to different species, were about the same size, it was supposed that they would live peaceably together. It was a mistake. During the following night the *Cerastes* swallowed the *Pelias berus*, and in order to accommodate himself to his huge prey, his body was distended so that the scales which touch each other laterally, and even lap in its normal state were now so spread apart that between the longitudinal rows, a bare space equal in size to the scales was left. Digestion went on regularly, however, and the *Cerastes* did not appear to suffer.

The author also remarked that snakes in general do not accept indifferently all sorts of food, but appear to exercise a choice. It is often difficult to induce a snake to take food for the first time, but once this is accomplished, it accepts more readily succeeding proffers. A *Pelophilus madagascariensis* has been known to refuse a variety of food for 22 months, when it ate a starling, then a few other small birds and finally some rats, which are still fed to him without any difficulty, although previously they had been offered to him in vain.

M. Vaillant also remarks that the residue of digestion are evacuated at a single time after each feeding, at the end of a certain number of days. However, it often happens that the fæces contain the residue of a former meal. (Revue Scientific, aont, 1892.)

ARCHEOLOGY AND ETHNOLOGY.[1]

International Congress of Americanists.—It is proposed in this department to make a series of sketches of some of the International Congresses held in Europe. Two of these Congresses, to wit, that of "Criminal Anthropology," of Brussels, and that of the "Americanists," at Huelva, voted to hold a special meeting in the United States during the Summer of 1893; both, presumably, to be at Chicago. The increased interest thus to be engendered justifies this publication.

THE FIRST INTERNATIONAL CONGRESS OF AMERICANISTS.—On the 25th of August, 1874, the Société Geographique Française held a meeting in the City of Paris, and formulated a Constitution, which should serve as a foundation for a new Society, to be called the Congrès Internationale des Americanistes.

The object was to contribute to the progress of Ethnographic, Linguistic, Historic studies relative to North and South America, and especially those of antiquity. The Historic or Proto-Historic portion would naturally be directed to the time of the discovery by Christopher Columbus.

Committees were appointed, officers and their duties provided, requisites of membership laid down, all in the shortest and simplest manner possible, and it finally provided that the First Congress should be held at the City of Nancy, on the 19th of July, 1875, and to continue four days.

The First Congress was entirely successful, and demonstrated the good judgment of its founders.

Twenty-eight countries were represented. Professor Henry, Secretary of the Smithsonian Institution, and Hon. Robert T. Winthrop, General Clary and Professor Henry W. Haynes, of Boston, were delegates from the United States; although it does not appear that the two former were present.

The report of the Treasurer showed 1572 subscriptions at 12 francs each, with total receipts of 23,106 francs. The meetings were held in the Ducal Palace, at Nancy, under Government patronage and protection; the city was put in gala costume, the palace and streets were draped with the flags of all nations, and there were the usual excursions, receptions, fêtes, concluding with the official banquet.

[1]This department is edited by Dr. Thomas Wilson, of the U. S. National Museum.

There was an Exposition of American Antiquities, principally from the collections of the Archeologists of two countries; the most extensive being that of a most esteemed friend, M. E. Boban, of Paris and Mexico.

The papers read and the subjects discussed are here given to show the scope of the organization.

Discovery of America before the time of Columbus, by M. Benedict Grondals, 7 pages; Discovery of the New World, by M. E. Beauvois, 52 pages; The Pheniciens in America, by Gaffarel, 48 pages; Buddhism in America, by M. Foucaux and M. De Rosny, with discussion, 12 pages; Fou-Sang, by Lucien Adam, 18 pages; Atlantis, by M. Chill y Naranjo, 3 pages; The Dighton Rock, by M. G. Gravier, 26 pages; A Dream of Christopher Columbus, by M. Castaigne, 23 pages; Inscription on the Grave Creek Tablet, by M. Levy Bing, 17 pages; America and the Portuguese, by M. Luciano Cordiero, with discussion by Professor Haynes, 97 pages; The Arctic and Antarctic Regions, by M. Daa; The Esquimaux, by R. P. Petitot; The Indians of the United States, by M. De Semallè, 9 pages; The Ancient Races of Peru, by M. John Campbell, 19 pages; Columbian Skulls, by M. Paul Broca, 16 pages; The Aborigines of Haiti, by Madiou; The Tradition of the White Man, by Madier De Montjau; An Iroquois Manuscript, by Leon De Rosny; The Mound Builders, by M. Joly; The Indians of French Guiana, by M. Dupont; The Caribs, by M. Ballet; The Origin of America, by Baron de Bretton; The Indians of Peru, by M. Ber; Le Maguey, by M. Gordron; The Guano of Peru, by M. Ridel; Language of the Cheyenne Indians and the Quichua, by Lucien Adam, 7 pages; Les Déné-Dindjies, by R. T. Petitot, 24 pages, and An Iroquois Manuscript; The Relation of Words, by Lucien Adam, 6 pages; Comparison between the Basque Language and Indian Languages of America, by M. Julien Vinson, 14 pages; Deciphering the Maya Language, by Leon De Rosny, 5 pages; Central America, by M. Blaise, 2 pages; The Society of Quakers, by M. Magnin; The Crees and the Chippeways by Lucien Adam, 59 pages; Anthropology in the Antilles, by M. Cornilliac, 22 pages; Traditions of the Greenlanders, by M. Rink and Valdemar Schmidt, 9 pages; The falsity of the Hebrew inscription found on a stone at Newark, Ohio, by M. Henry Harrisse, 7 pages; America in Antiquity, by Francis A. Allen, 47 pages; Asiatic Emigration to the New America, by R. P. Petitot, 11 pages; Ancient Mexican Stirrups, by Eugene Boban, 3 pages; Archeologic Analogies, by M. Morey, 7 pages; Prehistoric Canada, by M. Le Metayer-Masselin, 8 pages; The Museum of St. Petersburg, by M. Schoebel, 3

pages; Ancient American Music, by Oscar Comettant, 27 pages; Alphabet of one of the Ancient Languages in the interior of South America, by M. Pacheco-Zegarra, 28 pages; Memoire on the numeration of the Maya Language, Leon De Rosny, 20 pages.

The Second International Congress of Americanists was held at Luxembourg, from the 10th to the 14th of September, 1877. There were 1047 subscriptions, and the total receipts, including contributions, amounted to 18,338 francs. Twenty-seven countries were represented.

The titles of the papers presented and addresses delivered are as follows:—

The Ancient Pueblos, by Edwin A. Barber, 17 pages; The Mound Builders, by Mr. Robert S. Robertson, 26 pages; The Chinese in California, by M. Emile Guimet, 9 pages; Osteologic Evidence furnished by the Ancient Mounds of Michigan, by Mr. Henry Gillman, 15 pages; The Origin of Civilization in the New World, by Mr. F. A. Allen, 20 pages, with the Protestation, by M. L'abbe Hengesh, 4 pages; The Mound Builders, by Mr. S. D. Peet, 17 pages; To What Race Belonged the Mound Builders? by Judge M. F. Force, 25 pages; The Origin of the Language, Mythology and Civilization of America, found in the Old World, by Mr. Hyde Clarke, 14 pages; The History of America and its Discovery, by Mr. De Hellwald, 4 pages; The European Colonies in Markland and l'Escociland, in the XVI and XVII Centuries, by M. E. Beauvois, 61 pages; A Comparison between the Civil Legislation of the Mexicans under the Aztec Emperor, and of the Peruvians during the epoch of the Incas, by Sr. J. F. Nodal; The Route of the Mississippi, by M. Gabriel Gravier, 75 pages; Points or Marks in the Chronology of the History of the Mound Builders, by M. Stronck, 13 pages; The Migration of the Nahuas, by J. H. Becker, 26 pages; Address of Mr. Da Silva Paranhos and his criticism of the work of M. le Doctor Couto deMacalhaes, entitled "O Selvagem" or the Savage, being an investigation into the Antiquity of Man in South America, and especially in Brazil; Americus Vespucci, by Dr. Schoetter, 3 pages; Theories on Ka-kwaks, and their destruction by the Senecas, by Abbe Schmidt; Conquest of the Ancient Chilleans by the Peruvians in the times of the Incas, by M. H. Savary, 2 pages; Pay-Tuma, by Abbe Schmidt, 6 pages; Prehistoric Synchronism, by M. Anatole Bamps, 29 pages; The Discovery of Brazil by the French, by M. P. Gaffarel, 37 pages; Memoirs of Brazil, by M. Burtin; the voyage of Verrazzano, by M. Desimoni; The Ethnographic distribution of Nations and Lan-

guages in Mexico, by M. V. A. Malte-Brun, 36 pages; The Language Atacameña, by M. Moore, 22 pages; The Manuscript of M. Platzmann; The Indian Languages of America compared with the Ural-altaischen Languages, by Forchhammer, 19 pages; Is the Quichua an Aryian language? Being a critical examination of the works of Don V. F. Lopez; The Aryenne Races in Peru, by M. V. Henry, 83 pages; An inscribed tablet, by M. J. Gass, 2 pages; The Engraved tablet of Rockford, Illinois, and its evident fraudulent character, by N. Moody; A grammatical examination and comparison of 16 American Languages, by M. Lucien Adam, 83 pages; Principles of the Cree Language, by M. R. P. Remas, 10 pages; The Age of Stone, at the exposition of Philadelphia, 5 pages, by Emile Guimet; The National Library of Rio Janeiro, by Ferdinand Denis, 8 pages; American Antiquities in the Royal Netherland Museum at Leyden, by M. Leemans, 20 pages; A chapter in American Archæology, 16 pages, by C. Schoebel; A rock-shelter in Pennsylvania, by Mr. S. S. Haldemann, 8 pages; A primitive habitation of the Esquimaux, by M. H. Rink, 14 pages; The antiquity of Man in America attested by the Silex. The evidence upon which this paper relies to prove its proposition, is the similarity of the flint implements of America with those of Europe, by Jean Engling; The collection of M. Emile de Ville, Belgium Consul at Quito, and its proposed deposition or gift to the city of Brussels and its deposition in that Museum; Antiquities of Greenland, by M. Valdemar Schmidt, 3 pages.

The Third International Congress of Americanists was held at Brussels, from the 23d to the 28th of September, 1879.

The number of Nations represented was about the same at the two previous Congresses; while the number in attendance, and the papers read and addresses made were greater. The proceedings were reported in two large volumes containing together 825 pages, with an atlas of plates.

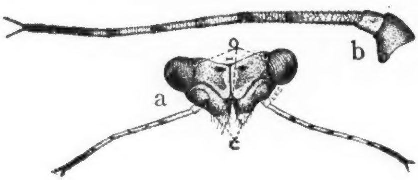
The following papers were read and addresses delivered:—

Pre-Columbian Historic Documents from Mexico and Anahuac, by M. Andre de Bellecombe, 13 pages; The Calpullis of Mexico, their administration, origin and communistic principles, by Mr. Ad. F. Bandelier, 3 pages; The Norambégue, with the proof of its Scandinavian origin furnished by the language, institution and belief of the Aborigines of Acadia, by M. Eugene Beauvois, 38 pages; The exploration of the Amazon by the Franciscans of Peru, by P. Servais Dirks, 31 pages; Progress of American Cartographie during the XVI Century, by Rev. F. B. De Costa, 8 pages; The same (Continued) by

M. Gabriel Gravier and by Lieut. Col. Adan, 89 pages; An unknown chart, the first one made by Louis Joliet in 1674, after his exploration of the Mississippi with Father Marquette in 1673, by M. Gabriel Gravieri with explanations by M. Lucien Adam, 38 pages; Observations on the earlier letters of Americus Vespucius, by Judge M. F. Force, 36 pages; On the influence of orography on the march of civilization in America and Europe, by Dr. Charles Barrois, 4 pages; Printing and Bookmaking in Spanish America, from the XVI to the XVII Century, by Vicente G. Quesada, 68 pages; The antiquity of different Canadian States, by M. Burtin, 3 pages; Verraxxano, discoverer of certain regions in North America, by Cornelio Desimoni, of Genoa, 67 pages; The Carib Language, and the differences between it as spoken by men and women, L. Adam; Peruvian Ceramics in the Society of Americanists at Nancy, by M. Jules Renauld, 20 pages; Christianity and the White Man in America before its discovery by Christopher Columbus, by Abbe Schmitz, 15 pages; The White Man and the Cross in America, by M. Peterkin, 20 pages; The White Man and the Cross in Peru before the Discovery by Columbus, by D. Marcos Jiminez de la Espada, 28 pages; Collection of M. Guesde, of Port-au-Prince, specially the Carib stone hatchet, 3 pages; American Antiquities recently acquired by the Royal Netherland Museum of Antiquities at Leyden, by Dr. Leemans, 3 pages.

Antiquities of Greenland, by Valdemar Schmidt, 6 pages; The last discoveries in the Mounds of America, by Rev. J. Gass, with a letter from M. Francis A. Allen, 26 pages; Effigy Mounds in America compared with those of the same kind in Europe and Asia, by Dr. Phéne, 7 pages; The probable destination of the Inca-Chunca, by Jean Van Volxem; Antiquities from the Equator at the Royal Museum at Brussels, by Anatole Bamps, 96 pages; The antiquities from the valley of San Augustine, United States of Columbia, by M. Jose Maria Gutierrez de Alba, 5 pages; The discourse of Dr. Virchow; The influence of American surroundings upon the White Race, by M. Grattan, 8 pages; Existence of Man in North America during the Glacial Period, by M. Sidney Skertchly, 4 pages; The reefs of St. Paul and the question of Atlantis, by Abbe Renard, 22 pages; The last of the Mexican Races in the United States; by M. Edwin A. Barber, 6 pages; The highest antiquity of Man in America, by M. Florentine Ameghino. This paper has reference to the man during the tertiary period in Brazil, 52 pages; Cosmogonye Algique, by Count de Charencey, 28 pages; Origin of the Primitive Indians of South America; by Mme. Marcella J. Wilkins, 8 pages; A critical examination and comparison of fourteen

PLATE V.



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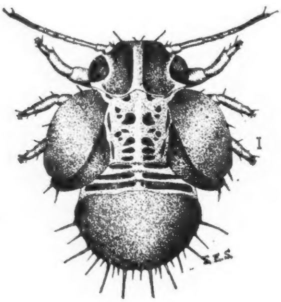

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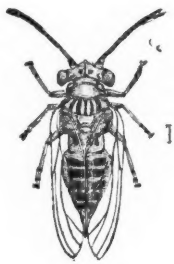

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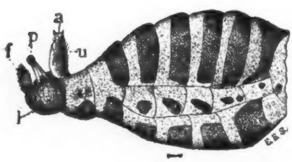

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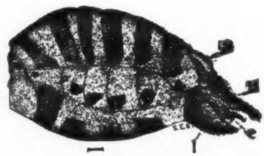

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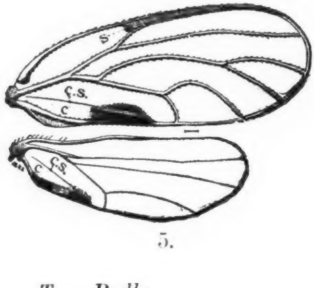

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The Pear Tree Psylla.

American Languages, by M. Lucien Adam, 61 pages; Grammar of the Moskito Language, by Edward Grunewald, and Dictionary of the same, Moskito and German; Inscribed Stones purporting to be in Hebrew, from Licking County, Ohio, by M. Charles Whittlesey; A comparative grammar of three languages of Greenland, by Victor Henry; A comparison between the Aymara of the Quichua and the dialect of Quito, by Jose Fernandez Nodal; Principles of Language and Othomie, by Professor de Harlez, 45 pages; The Affiliation of American languages, by M. John Campbell; A Communication on the Idol of Guaqui, by M. Marcos Jiminez de la Espada; Philologic Notes, by M. P. Vegreville, 39 pages; The Mexican Calendar, by Manuel Orozcoy Berra; Ancient inscriptions in the Argentine Republic, by Florentine Ameghino, 27 pages; Prehistoric Clocks in South America; The language Maskoki and its dialects, by M. Albert S. Gatschet, 16 pages; The deciphering of certain Maya characters, by the Count de Charency.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Society of Naturalists.—This body met at Princeton, N. J., in J. C. Green Science Hall of Princeton College, on December 28–9, 1892. Professor Osborn, of Columbia College, N. Y., was President, and Professor T. H. Morgan, of Bryn Mawr College, Pa., was Secretary. On the afternoon of Dec. 28th, President Patton, of Princeton College, gave an address of welcome. A committee was appointed to confer with the executive committees of the affiliated societies to bring about a union between the societies of Morphologists and Anatomists. Professor Sedgwick read a report by Professor S. F. Clark, on Science Teaching in Schools. Reports on Marine Biological Laboratories were presented by Dr. E. A. Andrews, of Johns Hopkins University on the Marine Station in Jamaica; Dr. D. Bashford Dean read a paper on the Marine Laboratories of Europe, which was handsomely illustrated; Professor C. O. Whitman read a paper on the Outlook of the Marine Laboratory at Woods Holl, Mass. Dr. Stiles read a report of progress in obtaining support for an American table at the Marine Laboratory at Naples. The Society adopted resolutions favoring the establishment and continuous support of a table at that Laboratory.

In the evening the Annual Dinner took place in University Hall After the address by the President, Professor Osborn, remarks were made by Professor Brewer, of Yale, Professor Cope, of Pennsylvania, Dr. Heitzman, of New York, Professor Minot, of Harvard, and others.

On Dec. 29th, the following members were elected: Howard Ayers, J. H. Bamhart, G. W. Calkins, T. M. Chapman, D. Bashford Dean, D. G. Elliot, B. D. Halsted, Ida A. Keller, Edwin Linton, T. B. Lotsy, J. I. Peck, H. S. Pratt, J. E. Reighard, Wm. E. Ritter, J. P. Smith, O. S. Strong, R. Thaxter, H. H. Wilder, Arthur Willey, J. L. Wortman.

Professor Libbey offered the following resolution, which was carried: That a committee be appointed to bring about an affiliation of the Physiological, Morphological, Anatomical and Geological Societies with this body.

New Haven was adopted as the next place of meeting. The following officers were elected for the ensuing year: President, Professor R. H. Chittendon, New Haven; Vice-Presidents, Professor G. Baur, Chicago, and Dr. Wm. H. Dall, Washington, and Professor Wm. Libbey, Princeton; Secretary, Professor T. H. Morgan, Bryn Mawr, Pa.;

Treasurer, Professor W. T. Sedgwick, Boston; Executive Committee, Professor W. G. Farlow, Cambridge; Professor J. A. Ryder, Philadelphia.

Special reports on the work of the preceding season were made by Professor W. Libbey, Jr., on the summer work of the U. S. Fish Commission schooner, Grampus; by Dr. J. L. Wortman on the Exhibitions of the American Museum of Natural History in New Mexico, Wyoming and Dakota; and by Professor E. D. Cope on the Paleontological Exploration of the Staked Plains of Texas by the Geological Survey of Texas.

On Dec. 29th the Annual Discussion took place. The question was, What were the former Areas and Relations of the American Continent as determined by Faunal and Floral Distributions? The discussion was opened by a paper from Professor W. B. Scott, of Princeton, on "Evidence from past and present Distribution of Mammalia." Professor J. A. Allen read a paper on the Evidence from the Distribution of Birds; and Dr. N. L. Britton on Evidence from the Distribution of Plants.

American Morphological Society.—The annual meeting was held at Princeton, N. J., Dec. 28–29, 1892. The following papers were read: Dr. E. B. Wilson, Columbia College, The cleavage of the ovum and the teloblasts of Amphioxus. Dr. C. W. Stiles, Department of Agriculture, Washington, The topographical anatomy in the family Tæniadæ. Dr. E. O. Jordan, University of Chicago, The maturation and Fertilization of the egg of the Newt. Professor E. D. Cope, Philadelphia, False Elbow Joints in Man and the Horse. Mr. Arthur Willey, Columbia College, On Acinetæ parasitic in the buccal tube of Diplosoma. Dr. C. B. Davenport, Harvard College, The development of the cerata of Eolis. Dr. H. B. Ward, University of Michigan, The host of Nectonema. Dr. C. O. Whitman, University of Chicago, The metamerism of Clepsine. Dr. W. B. Scott, Princeton College, The evolution of the premolars. Dr. H. A. Ayers, of the Lake Laboratory, Milwaukee, The ending of the auditory nerves in the hair-cells. Dr. E. A. Andrews, Johns Hopkins University, Notice of a new sort of Amphioxus. Professor A. E. Verrill, Yale College, Some New forms of Nemerteans. Dr. T. H. Morgan, Bryn Mawr College, Preliminary note on Balanoglossus. Professor B. Sharp, Academy of Natural Sciences, Philadelphia, Joint formation among the Invertebrata. Professor W. A. Locy, Lake Forest University, The formation of the

medullary grooves, and some other features of embryonic development in the Elasmobranchs.

The following gentlemen were elected officers for the current year: President, Dr. C. O. Whitman, University of Chicago; Vice-President, Dr. E. B. Wilson, Columbia College; Sec'y-Treas., Dr. J. Playfair McMurrich, University of Cincinnati. Members of the Executive Committee elected from the Society-at-large: Dr. T. H. Morgan, Bryn Mawr College; Dr. C. B. Davenport, Harvard College.

Association of American Anatomists.—Fifth annual session, Tuesday to Thursday, December 27 to 29, 1892, at Princeton, N. J. The officers for the year 1891-1892 were—President, Harrison Allen, M. D., Philadelphia; First Vice-President, Charles Heitzman, M. D., New York City; Second Vice-President, Theodore N. Gill, M. D., Washington, D. C.; Secretary and Treasurer, D. S. Lamb, M. D., Washington, D. C. Executive Committee: Thomas Dwight, M. D., Harvard University; E. C. Spitzka, M. D., New York City; Dr. F. H. Gerrish, Portland, Me., the President and Secretary, ex-officio. Committee on Anatomical Nomenclature: Harrison Allen, M. D., Philadelphia; Frank Baker, M. D., Washington; Thomas Dwight, M. D.. Harvard University; Thomas B. Stowell, Ph. D., Potsdam, N. Y.; Burt G. Wilder, M. D., Cornell University, Secretary. Delegate to American Congress of Physicians and Surgeons, F. J. Shepherd, M. D., Montreal, Canada. Alternate, R. W. Shufeldt, M. D., Washington, D. C.

Tuesday, December 27, the following business was transacted: 1, Opening of the session by the President; 2, Report of the Executive Committee; 3, Report of the Secretary and Treasurer; 4, Election of new members; 5, Report of the Committee on Anatomical Nomenclature; 6, amendment to Constitution, abolishing dues and substituting assessments; 7, Miscellaneous business.

Then followed the address of the President, Dr. Harrison Allen.

The following papers were read: 1. History of the development of bone tissue. Illustrated by microscopic slides. Dr. Carl Heitzmann, New York City; discussed by Professors Macloskie and Libbey. 2. Crania of the Cetacea (15 minutes), with specimens, Dr. Harrison Allen, University of Pennsylvania. 3. The human lower jaw (10 minutes), with specimens, Dr. Allen. The second and third discussed by Dr. Herrick and Professor Macloskie. 4. An anomalous human sternum, Dr. C. S. Lamb, Washington, D. C. Discussed by Dr. Dwight. 5. Observations on the psoas parvus and pyramidalis. A study on variation, Dr. Thomas Dwight, Harvard University. 6.

Significance of percentages in reversions in human anatomy, Professor H. F. Osborn, Columbia College, New York. Discussed by Professor Cope and Drs. Dwight and Lamb. 7. Series of thirty-five natural-size photographs of sections of human brain, with brief remarks, Dr. I. S. Haynes, University of New York. 8. Histogenesis in the brain, and its bearings on development and decline, Professor C. L. Herrick, University of Chicago. Discussed by Drs. Heitzmann and Piersol. 9. The metapore or foramen of Magendie, with photographs, Professor G. B. Wilder, Cornell University. Read by Mr. Clark. 10. Neuromerism and the cranial nerves of Ophidia, Professor Herrick. 11. The insula of the pig, with specimens, Tracy E. Clark, B. S., Clinton Liberal Institute, Fort Plain, N. Y. Discussed by Drs. Allen, Dwight and Spitzka. 12. The posterior surface of the liver; described by Vesalius; Dr. F. H. Gerrish, Bowdoin College, Maine. Discussed by Drs. Dwight, Heitzmann and Allen. 13. Embryos of bats, (with specimens), Dr. Allen. Discussed by Professors Cope and Minot. 14. Meckel's diverticulum, Dr. D. S. Lamb, Army Medical Museum, Washington. Discussed by Drs. Minot and Dwight. 15. Delimitation of abdominal regions, Dr. E. A. Balloch, Howard University, Washington. Read by the Secretary. 16. The need of agreement in the limits of the abdominal regions, Dr. Gerrish. Discussion of the last two papers together, by Dwight, Piersol, Kemp, Heitzmann and Lamb. 17. Physical characters of the Kootenay Indians, Mr. Alex. F. Chamberlain, Clark University, Worcester, Mass. 18. Discovery of an ossified thyroid cartilage, and a supposed rudimentary clavicle in an artiodactyl, with the specimen; Professor W. B. Scott, Princton, N. J. Discussed by Professor Cope and Dr. Allen. 19. Notes on diagrams of the spinal cord, Dr. J. T. Duncan, Toronto, Can. 20. Duration of motion of human spermatozoa, Dr. Geo. Piersol, University of Penna. Discussed by Drs. Spitzka and Heitzmann. 21. The innervation of the organ of Corti, Dr. Howard Ayers, Lake Laboratory, Milwaukee, Wis. Microscopical slides, with remarks.

New York Academy of Sciences.—Biological Section, Jan. 9.—The following papers were presented:—A. A. Julien, Suggestions in Microscopical Technique, including (*a*) a carrier of cover impressions (mycoderm blood) utilizing as clamps a coil of brass wire mounted in a phial. The same device with a platinum coil serves as a convenient staining phial for cover glass preparations; (*b*) a suggested medium for mounting delicately contractile protoplasmic objects; (*c*)

devices for avoiding inclusion of air bubbles in mounts; (*d*) balsam-paraffin as a ring varnish.

O. S. Strong: On the components of cranial nerves of Amphibia. In the seventh a dorsal root was shown to pass off into branches representing ophthalmicus superficialis, facialis and buccalis of fishes, and innervating the lateral sense organs of the head. In vagus, a root of similar internal origin passes into the R. laterales, innervating the lateral sense organs of the body. Another component of the facialis is the fasciculus communis of fishes. This passes off into the palatinus and mandibularis internus, innervating the mucous epithelium of the oral cavity; while in the glosso-pharyngeus and vagus, similar components divided from this fasciculus innervate in like manner portions of the alimentary canal and its appendages. The relation of the results to segmentation of head was discussed.

N. L. Britton: A Review of the N. A. species of *Lespedeza*, with comments on the eleven native species, shown to be divisible into two groups, (*a*) those producing both petalous and apetalous flowers, and (*b*) those in which no petalous flowers are developed. Of the two naturalized species, one in S. E. part of U. S., *L. striata* (Thunb.) H. and A., is a native of E. Asia, appearing (about 1845) in Georgia.

BASHFORD DEAN, *Rec. Secy. of Section.*

Proceedings of the New Mexico Society for the Advancement of Science.—Meeting of November 2, 1892, at La Cruçes.—(No. 1.) Professor Townsend read a paper entitled "A partial comparison of the insect fauna of the Grand Cañon with that of the San Francisco Mountain in Arizona." The paper discussed briefly the conditions which exert an influence on the vertical range of species, and then gave some exact data on the topographical features of the above region. Dr. Merriam's life-zones of the San Francisco Mountains were re-stated, and the following provisional zones were offered for the Grand Cañon (from top of south rim at Hance's, 7500 ft., to Colorado River, 2500 ft.):

Canadian or balsam fir zone (only on north or northeast exposure).

Neutral or pine zone (only on north or northeast exposure).

Piñon or cedar zone—6000 to 7500 ft. (top of south or southwest exposure).

Sub-desert zone—4500 to 6000 ft.

Gila zone—2500 to 4500 ft.

The insect fauna was considered in three sections—that peculiar to the cañon, that peculiar to the mountain, and that common to both. These divisions were compared with each other, and also with the fauna

of the surrounding region. Specimens of insects were exhibited, belonging to these three divisions of the fauna, and many photographs and views of the cañon region were shown.

(No 2.) "Exhaustion and renewal of soils," by Professor Arthur Goss. He first described soils chemically, and told where they obtain their various constituents. He next divided the productive existence of a soil into three periods—1. The pioneer period. 2. The period when soiling crops are necessary. 3. The fertilizer period. The desired thing in fertilizers is the element or compound which has been taken from the soil. The best way to find this is not by chemical analysis of the soil, but by judicious experimentation.

(No. 3.) Professor C. T. Hagerty read a paper entitled "Computation of the Comparative strength of Insects and the Higher Animals." He proved conclusively that the higher animals are much stronger than insects in proportion to their size, and readily accounted for the apparent superior strength of the latter. In the course of his remarks he referred to a computation on the comparative strength of the honey-bee and horse, made by Miall and Denny in a work entitled "The Cockroach" (page 82, edition of 1886), and pointed out an error in their computation. They state that the relative muscular force of the horse is more than fourteen times as great in comparison with that of the bee as it would be if the muscles of both animals were similar in kind and the proportions of the two similar in all respects, and he showed that according to their own method of solution, it would be 3.08 instead of 14. Quite a number of specimens of the insect fauna of Grand Cañon and the San Francisco Mountains of Arizona were exhibited by Professor Townsend, besides some photographs taken during the trip.

Dec. 1, 1892.—(No. 1.) Professor Townsend read a paper entitled "Notes on the occurrence of the puma (*Felis concolor* L.) in Southern New Mexico." The animal was reported on good authority as tolerably common in the Organ Mountains, and still more so farther east on the Peñasco River in Lincoln County. It has killed colts in Soledad Cañon (Organ Mts.). Measurements of some large skins are given, one of more than eleven feet being vouched for on good authority.

(No. 2.) Notes on the Ferns of the Organ Mountains, by Professor E. O. Wooton, following the distribution zones of ferns as advanced by Dr. Underwood in "Our Native Ferns and Their Allies" (pages 61–65, edition of 1888), he enumerated the various species and genera which had been collected on several trips to the mountains without any idea of such paper in view. Whole number of Genera collected, 7;

whole number of Species collected, 16. He then noticed the general characteristics to be: rigid stems, thick leaves, deeply-seated veins, fronds either very hairy, chappy, granulated, or with very thick epidermis. All of which characteristics were taken as being simply different ways of protecting themselves from the intense dryness of the climate.

(No. 3.) "Notes on the Mound Builders," by Professor J. P. Owen, was a paper concerning what is known of that ancient race. The professor showed, in several different ways, the difference between this race and the North American Indian found in possession of this continent at its discovery. He told of the migrations of this pre-historic race from the south and west to the central and northern states, and their probable return to the sections from whence they came. He led us to believe that these ancient peoples might have been connected with our Pueblo Indians, and were connected with the Aztec tribes of Mexico.

International Congress of Zoology.—The second meeting was held at Moscow, August, 1892. The fellowing papers were read:—

General Questions Concerning Biology:—Reply to questions proposed by Professor L. Cosmovici: 1. On a definite division of the animal kingdom into "phyla." 2. Natural basis of a system of the type of worms. 3. Uniformity in the terminology of the secretory organs of worms, J. von Kennel.—Observations on some points in Zoological Nomenclature, Ch. Girard.—On the importation and hybridization of reptiles and amphibians, J. de Bedriaga.

Special questions Concerning Biology:—Note on *Parapagurus pilosimanus*, a Pagurid from the abyss of the Atlantic Ocean, A. Milne Edwards and E. L. Bouvier.—Note on the fauna of the Black Sea, P. N. Bontchinsky.—On a fresh-water Thuricola, F. Vejdovsky.—Essay on the Classification of Animal variations according to their causes, A. Brandt.—The fauna of the eastern part of the Baltic Sea, and the problems for the next investigations in that fauna, Gr. Kojevnikov.—Geographical Distribution of the carnivora, Ch. Grévée.—The European and Circum-Mediterranean vipers, J. de Bedriaga.—*Chalcides symonyi* Steind., and *Molge luschiani* Steind., J. de Bedriaga.—Notes on the nests of insects made of clay, H. von Ihéring.—The Cetaceans of the Black Sea, living and fossil, J. van Beneden.—On the geographical distribution of the Cladocera, T. Richard.—On the Monodontophrya, a new species of the Opalinidæ, Fr. Vejdovsky.

Histology and Embryology:—Contributions to the theory of the mesoderm and of metamerism, N. Cholodovski.—Note on the forma-

tion of the germ of the peripheral nervous system, A. Plitzine.—Note on the development of the endothelium of the heart in the amphibians, V. Roudnev.—On the development of *Chrysopa perla*, Mme. O. Tichomirova.—On the segmentation of the egg, and the formation of the blastoderm of the Pseudoscorpionidæ, Fr. Vejdovsky.—On an embryonic organ of the Pseudoscorpionidæ, Fr. Vejdovsky.—Contribution to the history of the parasites of the Hymenoptera, N. Koulaguine.—The use of embryological researches for classification, A. Tichomiroff.

Physiology and Physiological Chemistry:—On the phosphorescence of animals in the Black Sea, P. Khvorostansky.

Morphology and Comparative Anatomy:—What is meant by "the water vascular system, the segmental organs, the excretory organs, and the nephridia, L. Cosmovici.—Presence or absence of an excretory apparatus in the genital organs of the Metazoa, H. von Ihering.—Note on metameric signification of the cranial nerves, P. Mitrophanov.—Position of the Strepsipteridæ in the system according to the data of post-embryonic development and of anatomy, N. Nassonov.—On the excretory organs of terrestrial arthropods, A. O. Kovalevsky.—On the origin and ancestry of the Arthropods, particularly the tracheated arthropods, N. Zograf.

Boston Society of Natural History.—January 18, 1893.—The following paper was read: Report on a study of Glacial sand-plains in Eastern Massachusetts, illustrated by lantern slides, by Professor W. M. Davis and students in geological field-work in Harvard University. SAMUEL HENSHAW, *Secretary.*

SCIENTIFIC NEWS.

Recent Deaths.—HENRY TIBBOTS STAINTON.—Word comes from England of the death of this eminent Lepidopterist on December 2d, 1892, in his 71st year. For the past fifty years he has been one of the most active British entomologists. During this period he has been president of the Entomological Society of London, secretary and vice-president of the Linnean Society, and secretary of the Ray Society. One of the founders of the *Etomological Monthly Magazine*, he continued on the editorial staff from its beginning until his death. From this magazine we learn that he has published more than twenty-five volumes on natural history, besides frequent contributions to entomological periodicals. He studied chiefly the Micro-Lepidoptera, and was best known as a student of the Tineina. Two of his associates on the *Monthly Magazine*, Messrs J. W. Douglas and R. McLachlan, write: "Naturally diffident and unobstrusive in society, he yet pursued the objects that interested him, with ardor and perseverance, and his liberality in the cause of the advancement of entomological studies in Britain, which was always dear to him, and his unstinted aid in the identification of species, are too well known to require eulogy. From the first he restricted his researches to Lepidoptera, but he had sympathy with the students of all orders of insects, and of natural history generally. Possessed of an ample fortune, he used his means freely to assist any cause or person that he deemed to be deserving . . . In 1871 he was instrumental in founding the Zoölogical Record Association, for the purpose of continuing the Zoological Record, which had been relinquished by Er. Van Voorst, and largely through his liberality this indispensable publication appeared regularly until 1886, when it was taken up by the Zoological Society of London."

FREDERICK AUGUSTUS GENTH.—The death of Frederick Augustus Genth occurred at his residence, No. 3937 Locust street, Philadelphia, and ended, at the age of seventy-three, the career of a chemist and mineralogist whose reputation was not confined to one hemisphere, but was co-extensive with the world of scientific investigation. Professor Genth was born in Waechtersbach, Hesse-Cassel, on May 17, 1820. After attending the Gymnasium, in Hanau, he studied at the University of Heidelberg, under Liebig; at Giessen, and finally under Bunsen, at

Marburg, where he received the degree of Ph. D. in 1846. For three years he acted as assistant to Professor Bunsen, and soon afterward came to the United States, where he has since resided.

In 1872 he was called to the chair of chemistry and mineralogy in the University of Pennsylvania, which place he held up to within a few years ago. He had also held the office of chemist to the Geological Survey of Pennsylvania, and also to the Board of Agriculture of this State. Professor Genth was a member of many scientific societies in the United States, and was elected in 1872 to membership to the National Academy of Sciences. He had no superior in this country as an analytical chemist, and he greatly enriched the literature of chemistry with his very many and careful analyses of minerals. His name is associated with the ammonia cobalt bases, which he discovered in 1846, and, in joint authorship with Dr. Wolcott Gibbs, he contributed to the "Smithsonian Contributions to Knowledge," a monograph on "Researches on the Ammonia Cobalt Bases" (Washington, 1856).

Professor Genth was the author of nearly one hundred separate papers on subjects in chemistry and mineralogy, and published *Tabellarische ubersicht der Uichtigsten Reactionen welche Basen in Salzen zeigen* (Marburg, 1845); also the same in relation to "Acids" (1845); his "Minerals of North Carolina," being appendix "C" of the "Report on the Geology of North Carolina" (Raleigh, 1875). He also was the author of "First and Second Preliminary Reports on the Mineralogy of Pennsylvania" (Harrisburg, 1875–6) and "Minerals and Mineral Localities of North Carolina" (Raleigh, 1881).

Nikolai Ivanovitch Koksharoff, the well-known Russian mineralogist, died at St. Petersburg, January 2, 1893. During his early years he lectured on geology and physical geography, but later on devoted himself to the description of Russian minerals of which he discovered, and described many new ones. His chief works are embodied in eleven large quarto volumes of Beiträge zur Mineralogie Russlands, illustrated with numerous plates. The twelfth volume was in type when he died. He was a member of the St. Petersburg Academy of Sciences, and many of the scientific bodies of Western Europe elected him corresponding or honorary member.

—The address delivered by Professor Virchow on his assumption of the office of Rector of the University of Berlin, has been issued by the

German publisher, August Hirschwald, of that city, under the title "Lernen und Forschen."

Unofficial information has been received by Professor G. Brown Goode, of the National Museum, and member of the United States Commission to the Madrid Exposition, that awards have been made to the following exhibitors from this country:—

Gold medals — Smithsonian Institution, Bureau of Ethnology, National Museum, University of Pennsylvania, William Ellery Curtis, of Washington; the Hemenway Expedition, Dr. J. Walter Fewkes, of Cambridge.

Silver Medals—United States Geological Survey, the Numismatic and Antiquarian Society of Philadelphia, the Philadelphia Academy of Natural Sciences, the Peabody Museum of Archeology, Cambridge; The United States Mint, the United States Navy, The Army Medical Museum, Dr. D. G. Brinton and Mr. Stewart Culin, of Philadelphia; Professor O. T. Mason, Professor Thomas Wilson, Mr. W. H. Holmes and Mr. Walter Hough, of Washington; Mrs. Zelia Nuttall, of Cambridge.

Bronze Medals—Fish Commission, Department of Agriculture; Indian School at Carlisle, Pa.; Sons of the American Revolution, Dr. James C. Welling and Mrs. Tillie E. Stevenson, of Washington; Dr. Cyrus Adler, of New York; Mr. Warren K. Moorehead, of Xenia, O.

The gold medals, it is understood, are very handsome, with an intrinsic value of $150 apiece. Final action by the jury is not known, and others may be honored.

At the annual meeting of Bowdoin College Alumni held at Boston, Jan. 25th, Professor Robinson of the chemical department of Bowdoin, announced that Mr. Edward F. Searles, whose wife, the widow of Mark Hopkins, left him millions, had promised to erect the finest and best equipped building for the study of the sciences that could be had in this country. He stated that Mr. Searles had placed no limit on the cost.

Dr. Osaun has been appointed Geologist on the Geological Survey of Texas, and will take charge at once of the petrographic work of the Survey. Dr. Osaun is well qualified for the position, having been for many years first assistant to Professor Rosenbusch, in Heidelberg, and, later, extraordinary professor of mineralogy and petrography in that University.

Dr. Karl Spruner von Merz, the author of "Historisch Geographischer Hand Atlas," died August 24th, 1892, at the age of 89. His great work, commenced in 1837, was not completed until 1852. Spruner was also the author of two school atlases of historical geography.

The University of Cape Town has been admitted to affiliation with the University of Cambridge. This is the second of the Colonial Universities thus affiliated, the other being that of New Zealand.

According to the Anatomischer Anzeiger, the Biological station at Plön, under the direction of Dr. Otto Zaccharias, has accomplished successful work during the past Summer. Of the species of animals occurring in the Lake of Plön, there have been determined 20 fishes, 40 crustacea, 69 worms, 14 mollusca, and 74 protozoa. Of greatest interest is the discovery in fresh water of many organisms that have hitherto been supposed to occur only in the sea; and among these more especially may be noted certain genera of diatoms, rhizopods and worms. An illustrated report on results is soon to be published.

—Dr. R. von Wetlstein has been appointed Professor of Botany in the University of Prague, Bohemia.

—Mr. E. E. Prince, M. A., Professor of Zoology in St. Munigo's College, Glasgow, has been appointed Commissioner and General Inspector of Fisheries in Canada.

The Indiana Academy of Sciences has issued its Proceedings for 1891, in the shape of a pamphlet of 176 pages. It contains not only the proceedings of that year, but also a list of all papers read before the Academy since its organization in 1885. The Academy has 121 active, 11 non-resident and 1 honorary members. Copies of the Proceedings may be had of the secretary, Amos W. Butler, Brookville, Indiana.

Professor Bohumil Shimek has gone to Nicaragua to collect in the interests of the State University of Iowa. He will pay especial attention to the invertebrata and the cryptogamous plants.

Bulletin No. 40, of the U. S. National Museum, contains the fourth of the bibliographies of American Naturalists, that of George N. Lawrence by L. S. Foster, 121 titles are enumerated. A good steel portrait accompanies the Bulletin.

New York, Feb. 3.—A broad smile illumined the folio face of Caliph, the hippopotamus at the Zoo this afternoon. In the tank adjoining his a baby had arrived at exactly 12.15 P. M., and Miss Murphy, his mate, was its happy mother. Director Smith and his keepers knew Tuesday that something was in the air, for Miss Murphy was restless and excited. She is a nervous animal at all times, but Thursday she paced her cage all day, and Thursday night did not lie down once. The warning came just in time, and a thick straw bedding was given her, and the partition separating her from Fatima was put up. The latter has the empty tank and the mother has the landing.

After the youngster came, Mr. Smith said the first thing it did was to walk about shaking its tiny ears and giving little grunts. Murphy followed wherever it went, and would allow no one to approach within the railing, and so he didn't attempt it. Caliph meanwhile found a peek-hole in the boards, and viewed his progeny with a great deal of interest. He refused to go into his tank, and last night slept within touch of the mother and baby.

The baby weighs about thirty pounds, being very small. Its color is pink—a salmon hue—and its legs are so short as to be almost imperceptible at first sight. It is lively and runs about a great deal, much to the mother's discomfort. It is a peculiarly shaped animal. It might be said that it has no shape at all. It is about eighteen inches long, has no tail, ears that can hardly be seen and mouth no larger than a pint cup. The mother guards it with a great deal of care. It is her third born. Four years ago one was born which weighed sixty-three pounds. It died. Fatima came next, having been born October 4, 1890. Murphy is 8 years old and cost $5000. She weighs between 3000 and 4000 pounds. Caliph was brought from the Cincinnati Zoo and cost $5000. He weighs 7000 pounds. To-night Murphy and her baby were doing nicely.—*Late paper.*

Table of Contents of the North American Review for February, 1893.—How to Revise the Tariff, by the Hon. Wm. M. Springer, Chairman of the Ways and Means Committee; Recollections of the Panama Canal Congress, Rear-Admiral Ammen, U. S. N.; Changes in the Church of England, The Dean of St. Paul's; Criminal Law in France, Madame Adam; Boons and Banes of Free Coinage, I. "In the Interest of Shylock," by the Hon. R. P. Bland, Chairman of the Committee on Free Coinage, Etc., II. A Warning to Savings Bank Depositors, by John Harsen Rhoades, President of the Green-

wich Savings Bank, N. Y., III. A Depositor's Point of View, by a Depositor in a Savings Bank ; Wild Stag Hunting in Devon and Somerset, The Countess of Malmesbury ; Government Aid to the Nicaragua Canal, Senator John T. Morgan ; Shall Our Laws be Codified ? Frederic R. Coudert ; Needed Reforms in the Army, General John Gibbon, U. S. A ; Why Immigration Should Not be Suspended, Senator H. C. Hansbrough ; The Hope of a Home, Erastus Wiman ; Europe at the World's Fair, I. The British Section, by Sir Henry Trueman Wood, Secretary to the British Commission, II. The French Section, by Theodore Stanton, Commissioner Resident in Paris ; Notes and Comments, Mistakes—but Not of Moses, Charles W. Trickett ; Science and the Woman's Question, Lydia Lvovna Pimenoff ; From Renan's Point of View, Arthur Reed Kimball ; The American Common Schools, Rev. James A. King.

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Orders for Separata must be written on copy as orders on Separate pieces of paper may be lost.

To Exchanges, Publishers, Etc.

Books, papers and periodicals sent in Exchange or for review must be sent to Editors.

☞SPECIAL NOTICE

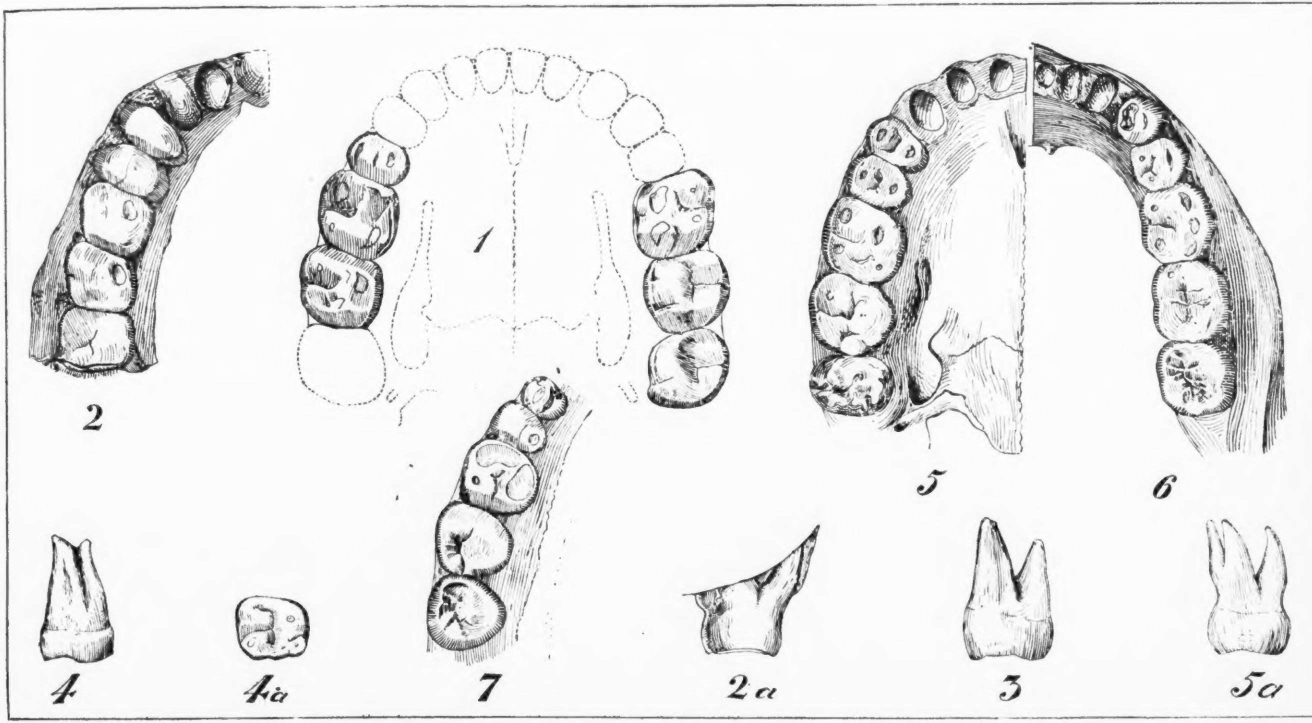
FROM THE PUBLISHERS.

Owing to the excess of matter in this issue, the publication was somewhat delayed. We shall always aim to get out each issue promptly on the first of each month, but our editors and authors being so wide-spread we are often delayed a few days in the return of the proofs of articles sent them for revision. With this explanation

we are, truly yours,

BINDER & KELLY.

PLATE IX.



1–2. *Man and Woman of Spy.* 3. *Maori.* 4. *Tahitian.* 5–6. *Fan.* 7. *Esquimaux.*